USER'S GUIDE

Vaisala HUMICAP® Humidity and Temperature Transmitter Series
HMT330
PUBLISHED BY

Vaisala Oyj
P.O. Box 26
FI-00421 Helsinki
Finland

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CHAPTER 1

GENERAL INFORMATION

This chapter provides general notes for the manual and the product.

About This Manual

This manual provides information for installing, operating, and maintaining Vaisala HUMICAP® Humidity and Temperature Transmitter Series HMT330.

Contents of This Manual

This manual consists of the following chapters:

- Chapter 1, General Information, provides general notes for the manual and the product.
- Chapter 2, Product Overview, introduces the features, advantages, and the product nomenclature of HMT330.
- Chapter 3, Installation, provides you with information that is intended to help you install the product.
- Chapter 4, Operation, contains information that is needed to operate this product.
- Chapter 5, Modbus, contains information that is needed when operating the transmitter using the Modbus protocol.
- Chapter 6, Maintenance, contains information that is needed in basic maintenance of the product.
- Chapter 7, Calibration and Adjustment, provides information and instructions concerning calibration and adjustment of HMT330.
- Chapter 8, Technical Data, provides the technical data of the product.
- Appendix A, Probe Installation Kits and Installation Examples, presents the installation kits available for HMT330 and provides some installation examples.
- Appendix B, Calculation Formulas, presents the equations used in HMT330 to calculate values of dewpoint, mixing ratio, absolute humidity and enthalpy in normal pressure.
- Appendix C, Modbus Reference, describes the Modbus functions and data of the transmitter.
Version Information

Table 1 Manual Revisions

<table>
<thead>
<tr>
<th>Manual Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M210566EN-I</td>
<td>Applicable from transmitter software version 5.10 onward. Added Modbus protocol. Updated serial line command descriptions. Updated storage temperature range.</td>
</tr>
</tbody>
</table>

Documentation Conventions

Throughout the manual, important safety considerations are highlighted as follows:

**WARNING** Warning alerts you to a serious hazard. If you do not read and follow instructions very carefully at this point, there is a risk of injury or even death.

**CAUTION** Caution warns you of a potential hazard. If you do not read and follow instructions carefully at this point, the product could be damaged or important data could be lost.

**NOTE** Note highlights important information on using the product.
Safety

The Vaisala HUMICAP® Humidity and Temperature Transmitter Series HMT330 delivered to you has been tested for safety and approved as shipped from the factory. Note the following precautions:

**WARNING**
Ground the product, and verify outdoor installation grounding periodically to minimize shock hazard.

**CAUTION**
Do not modify the unit. Improper modification can damage the product, lead to malfunction, or make the product noncompliant with applicable legislation.

## ESD Protection

Electrostatic Discharge (ESD) can cause immediate or latent damage to electronic circuits. Vaisala products are adequately protected against ESD for their intended use. However, it is possible to damage the product by delivering electrostatic discharges when touching, removing, or inserting any objects inside the equipment housing.

To make sure you are not delivering high static voltages yourself:

- Handle ESD sensitive components on a properly grounded and protected ESD workbench. When this is not possible, ground yourself to the equipment chassis before touching the boards. Ground yourself with a wrist strap and a resistive connection cord. When neither of the above is possible, touch a conductive part of the equipment chassis with your other hand before touching the boards.
- Always hold the boards by the edges and avoid touching the component contacts.
Recycling

Recycle all applicable material.

Dispose of the unit according to statutory regulations. Do not dispose of with regular household refuse.

Regulatory Compliances

EU Declaration of Conformity

Vaisala HUMICAP® Humidity and Temperature Transmitter Series HMT330 is in conformity with the provisions of the following EU directives:

- Low Voltage Directive
- EMC-Directive
- ROHS Directive

Conformity is shown by compliance with the following standards:

- EN 60950-1: Information technology equipment – Safety – Part 1: General requirements.
- EN 61326-1: Electrical equipment for measurement, control, and laboratory use – EMC requirements – for use in industrial locations.
- EN 61000-3-2: Limits for harmonic current emissions.
- EN 61000-3-3: Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems.
DNV Type Approval

The Vaisala HUMICAP® Humidity and Temperature Transmitter Series HMT330 is found to comply with Det Norske Veritas' Rules for Classification of Ships, High Speed & Light Craft and Det Norske Veritas' Offshore standards.

Applicable tests carried out according to Standard for Certification No. 2.4, April 2006.

Table 2 Application, Location Classes

<table>
<thead>
<tr>
<th>Type</th>
<th>HMT330</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>B</td>
</tr>
<tr>
<td>Humidity</td>
<td>B</td>
</tr>
<tr>
<td>Vibration</td>
<td>A</td>
</tr>
<tr>
<td>EMC</td>
<td>B</td>
</tr>
<tr>
<td>Enclosure</td>
<td>B/IP65</td>
</tr>
</tbody>
</table>
Transmitters with LAN or WLAN Interface

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Transmitters with WLAN Interface

This equipment has been designed to operate with a 2 dBi half-wave antenna. Antennas with a gain greater than 2 dBi are prohibited for use with this device. The antenna impedance is 50 ohms.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (EIRP) is not more than that permitted for successful communication.

This Class [B] digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe [B] est conforme à la norme NMB-003 du Canada.
Patent Notice

The Vaisala HUMICAP® Humidity and Temperature Transmitter Series HMT330 is protected by, for example, the following patents and their corresponding national rights:

Finnish patents 98861 and 99164, French patents 6650303 and 9504397, German patents 69418174 and 19513274, Japanese patents 3585973 and 2801156, UK patents 0665303 and 2288465, and U.S. patent 5607564.

Trademarks

HUMICAP® is a registered trademark of Vaisala Oyj.

All other trademarks are the property of their respective owners.

Software License

This product contains software developed by Vaisala. Use of the software is governed by license terms and conditions included in the applicable supply contract or, in the absence of separate license terms and conditions, by the General License Conditions of Vaisala Group.

Warranty

Visit our Internet pages for standard warranty terms and conditions: www.vaisala.com/warranty.

Please observe that any such warranty may not be valid in case of damage due to normal wear and tear, exceptional operating conditions, negligent handling or installation, or unauthorized modifications. Please see the applicable supply contract or Conditions of Sale for details of the warranty for each product.
CHAPTER 2
PRODUCT OVERVIEW

This chapter introduces the features, advantages, and the product nomenclature of the Vaisala HUMICAP® Humidity and Temperature Transmitter Series HMT330.

Introduction to HMT330

The HMT330 transmitter provides reliable humidity measurement in a wide range of applications. Analog outputs can be chosen between current and voltage signals. Alternatively, digital outputs RS-232 (standard) or RS-422/485 (optional) can be selected.

The quantities measured and calculated by HMT330 are presented in Table 3 below. The quantities available as an option are presented in Table 4 below.

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Quantities Measured by HMT330</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>Abbreviation</td>
</tr>
<tr>
<td>Relative humidity (RH)</td>
<td>RH</td>
</tr>
<tr>
<td>Temperature (T)</td>
<td>T</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 4</th>
<th>Optional Quantities Measured by HMT330</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>Abbreviation</td>
</tr>
<tr>
<td>Dewpoint / Frostpoint Temperature (T_{df})</td>
<td>TDF</td>
</tr>
<tr>
<td>Dewpoint Temperature (T_d)</td>
<td>TD</td>
</tr>
<tr>
<td>Absolute humidity (a)</td>
<td>A</td>
</tr>
<tr>
<td>Mixing ratio (x)</td>
<td>X</td>
</tr>
<tr>
<td>Wetbulb temperature (T_w)</td>
<td>TW</td>
</tr>
<tr>
<td>Humid air volume / dry air volume (by volume or by weight) (H_2O)</td>
<td>H2O</td>
</tr>
<tr>
<td>Water vapor pressure (P_w)</td>
<td>PW</td>
</tr>
<tr>
<td>Water vapor saturation pressure (P_{sat})</td>
<td>PWS</td>
</tr>
<tr>
<td>Enthalpy (h)</td>
<td>H</td>
</tr>
<tr>
<td>Difference of T and T_{df}(ΔT)</td>
<td>DT</td>
</tr>
</tbody>
</table>
Basic Features and Options

- Several probes for various applications
- User-friendly display and keypad interface (optional)
- Calculated output quantities available
- Different probe mounting kits, sensor protection options and probe cable lengths
- Transmitter mounting kits for multiple installation purposes
- Chemical purge for applications where interfering chemicals in the measuring environment pose a risk
- Warmed probe and sensor heating for high humidity conditions (HMT337)
- Additional temperature sensor (HMT337)
- Support for Modbus serial communications protocol
- USB connectivity for service connections via the optional USB-RJ45 cable
- Optional modules:
  - Isolated power supply
  - Power supply module for AC mains power
  - RS-422/485-module
  - LAN and WLAN interfaces
  - Data logger module with real time clock
  - Additional analog output module
  - Relay module
Structure of the Transmitter

Figure 1  Transmitter Body

The following numbers refer to Figure 1 above:

1 = Signal + powering cable gland
2 = Cable gland for optional module, or WLAN antenna connector
3 = Cable gland for optional module or AC mains cable
4 = Cover screw (4 pcs)
5 = Display with keypad (optional)
6 = Cover LED
The following numbers refer to Figure 2 above:

1 = Service port (RS-232)
2 = DIP switches for analog output settings
3 = Power supply and signal wiring screw terminals
4 = Relay, data logger, RS-422/485, LAN, or WLAN module (optional)
5 = Grounding connector
6 = Power supply module (optional)
7 = Relay, data logger, or analog output module (optional)
8 = Humidity probe cable
9 = Temperature probe cable (optional)
10 = Galvanic isolation module (optional)
11 = Adjustment buttons (chemical purge buttons) with indicator LED
Chapter 2  ___________________________________________________________ Product Overview

Probe Options

The HMT331 is intended for demanding wall-mounted applications. The standard version has a fixed probe.

Figure 3  HMT331 Fixed Probe

The HMT331 short cable probe is a special version for use with the WLAN module and when LAN module and power supply module are simultaneously installed. It has the HMT333 probe on a short cable (21 cm), and a mounting plate with a probe holder.

Figure 4  HMT331 Short Cable Probe
Figure 5  Probe Options

The following numbers refer to Figure 5:

1  =  HMT333 for ducts and tight spaces  
2  =  HMT334 for high pressure and vacuum applications (up to 100 bars)  
3  =  HMT335 for high temperatures (up to 180 °C, vapor tight)  
   *  ) Flange available as an option  
4  =  HMT337 for high humidity applications (optional warmed probe)  
5  =  HMT338 for pressurized pipelines (up to 40 bar)  

For probe cable lengths, see Table 37 on page 175.
Warmed Probe HMT337

Temperature difference between the probe and external environment can cause a risk of condensation on the sensor. A wet probe cannot observe the actual humidity in the ambient air. If the condensed water is contaminated, the life span of the probe may shorten and calibration may change.

HMT337 probe shall be used in applications where condensation can occur due to high humidity and rapid humidity changes. The warmed probe is heated continuously so that its temperature is always higher than in environment. This prevents condensation on the probe. The power consumption of the warmed probe is slightly higher than other probes.

Filter Options

There are several filter types for HMT330. All filters are 12 mm in diameter with a female thread, and are compatible with all HMT330 probe models. The filters recommended for a probe type can be selected on the corresponding HMT330 order form.

For more information, see section Spare Parts and Accessories on page 178

Catalytic VHP Filter

Vaporized hydrogen peroxide (VHP) is a gaseous form of hydrogen peroxide that is commonly used in decontamination and sterilization. Hydrogen peroxide has relatively low saturation pressure which increases the possibility of saturation when used in humid conditions. When saturation conditions occur, liquid hydrogen peroxide will form on surfaces in the decontaminated space.

Vaisala HUMICAP® sensor is compatible with direct VHP exposure even at high concentrations and hundreds of VHP cycles up to saturation. The long term performance is very good at concentrations higher than typically used for sterilization. However, for the applications where full saturation is possible, Vaisala recommends using the catalytic VHP filter to protect the sensor and extend the calibration interval.

The catalytic filter is based on a generally known method where the H$_2$O$_2$ is split to H$_2$O and O$_2$. This reaction is produced by the catalyst layer that has been applied to the filter. As the filter prevents the VHP from reaching the humidity sensor, the sensor responds to humidity only. The catalytic filter affects the reading approximately +1 %RH at 300 pmm VHP, or +3 %RH at 900 ppm VHP (at 23 °C / 73.4 °F).
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CHAPTER 3
INSTALLATION

This chapter provides you with information that is intended to help you install the product.

Mounting the Housing

The housing can be mounted either without the mounting plate or with optional mounting plates.

Standard Mounting without Mounting Plate

Mount the housing by attaching the transmitter to a wall with 4 screws, for example, M6 (not provided).

Figure 6  Standard Mounting
Wall Mounting with Wall Mounting Kit

When mounting with wall mounting kit the mounting plate (Vaisala order code 214829) can be installed directly on wall or onto a standard wall box (also US junction box). When wiring through back wall, remove the plastic plug from the wiring hole in the transmitter before mounting.

![Figure 7 Mounting with Wall Mounting Kit](image)

The following numbers refer to Figure 7 above:

1. Plastic mounting plate
2. Mount the plate to wall with 4 screws M6 (not provided)
3. Arched side up
4. Attach the HMT330 to the mounting plate with 4 fixing screws M3 (provided)
5. Holes for wall/junction box mounting

![Figure 8 Dimensions of the Plastic Mounting Plate (mm/inch)](image)
The HMT331 short cable probe is designed to be wall mounted with the probe holder plate (Vaisala order code 226252). The probe holder plate is similar to the standard mounting plate, except for the probe holder at the bottom.

**Figure 9  Dimensions of the Probe Holder Plate (mm/inch)**
Mounting with DIN Rail Installation Kit

DIN rail installation kit includes a wall mounting kit, 2 clip-fasteners and 2 screws M4 × 10 DIN 7985 (Vaisala order code: 215094).

1. Attach two spring holders to the plastic mounting plate by using the screws provided in the installation kit.
2. Attach the HMT330 to the plastic mounting plate with 4 screws (provided).
3. Press the transmitter onto the DIN rail so that the clip-fasteners snap into the rail.

![Figure 10 Mounting with the DIN Rail Installation Kit](image)

Pole Installation with Installation Kit for Pole or Pipeline

Installation kit for pole or pipeline (Vaisala order code: 215108) includes the metal mounting plate and 4 mounting nuts for pole mounting. When mounting, the arrow in the metal mounting plate must point upward; see Figure 13 on page 31.

![Figure 11 Vertical Pole](image)

The following numbers refer to Figure 11 above:

1  =  Fixing brackets (2 pcs) M8 (provided) for 30 ... 102 mm poles
2  =  Mounting nuts M8 (4 pcs)
Figure 12  Horizontal Pole

The following number refers to Figure 12 above:

1  =  Mounting nuts M8 (4 pcs)

Metal mounting plate is included in rain shield with installation kit and installation kit for pole or pipeline.

Figure 13  Mounting with Metal Wall Mounting Plate

The following numbers refer to Figure 13 above:

1  =  Mount the plate to wall with 4 screws M8 (not provided)
2  =  Attach the HMT330 to the mounting plate with 4 fixing screws M6 (provided)
3  =  Note the position of the arrow when mounting. This side must be up when mounting.
Mounting Rain Shield with Installation Kit

The rain shield is highly recommended for outdoor installations, especially for transmitters with the display/keypad option.

Figure 15 Mounting the Rain Shield with the Installation Kit

The following numbers refer to Figure 15 above:

1 = Fasten the rain shield with the installation kit (Vaisala order code: 215109) to the metal mounting plate with 2 (M6) mounting screws (provided)

2 = Fasten the mounting plate with rain shield with installation kit to the wall or to the pole (see pole installation)

3 = Fasten the transmitter to the mounting plate with 4 fixing screws (provided)
Panel Mounting Frame

To enable a neat and dirt free embedded installation of the transmitter, a panel mounting frame is available as an option (Vaisala order code: 216038). The frame is a thin, flexible plastic frame for the transmitter, with adhesive tape on one side.

The frame is used to hide any rough edges of the installation hole, and provide a more finished look. Note that the panel mounting frame is not intended to bear the weight of the transmitter, and does not include any mounting supports.

Use the panel mounting frame as follows:

1. Use the frame as a template to mark the required size for the installation hole in the panel.
2. Cut the hole in the panel.
3. Mount the transmitter through the panel with suitable supports.
4. Remove the paper protecting the adhesive tape on the frame, and attach the frame around the transmitter. Refer to Figure 16 below.

![Figure 16 Panel Mounting Frame](image)

The following numbers refer to Figure 16 above:

1  =  Panel (not included)
2  =  Panel mounting frame
Wiring

Cable Bushings

A single electrical cable with screen and three to ten wires is recommended for power and analog/serial connections. The cable diameter should be 8 ... 11 mm. The number of cable bushings depends on the transmitter options. See the following recommendations for the cable bushings:

1 = Cable for signal/powering Ø8 ... 11 mm
2 = Cable for optional module Ø8 ... 11 mm
3 = Cable for optional power supply module Ø8 ... 11 mm
NOTE
When there is high electric noise level (for example, near a powerful electric motor) in the operating environment it is recommended to use shielded cable or take care that the signal cables are separated from other cables.

Grounding the Cables

Ground the screen of the electrical cable properly to achieve the best possible EMC performance.

Figure 19   Grounding the Screen of Electrical Cable
Refer to Figure 19 on page 35 when performing the procedure below.

1. Cut back outer sheath to desired length.
2. Cut back screen braiding or screen foil to dimension X.
3. Push the domed cap nut (item 1) and the seal insert with contact socket of the gland (item 2+3) onto the cable as shown in the diagram.
4. Bend over the screen braiding or screen foil by about 90° (item 4).
5. Push the seal insert with the contact socket of the gland (item 2+3) up to the screen braiding or screen foil.
6. Mount the lower part (item 5) on the housing.
7. Push the seal with the contact socket of the gland (item 2+3) into the lower part (item 5).
8. Attach the domed cap nut (item 1) onto the lower part (item 5).

**Grounding the Transmitter Housing**

In case you need to ground the transmitter housing, the grounding connector is found inside the housing; see Figure 2 on page 22. Note that the probe is connected to the same potential as the housing. Make sure that different groundings are made to the same potential. Otherwise harmful ground currents may be generated.

If it is needed to have galvanic isolation of the power supply line from the output signals, the HMT330 can be ordered with an optional galvanic isolation module. This module prevents harmful grounding loops.
Signal and Power Supply Wiring

When connecting the transmitter with 8-pin connector, see section 8-Pin Connector on page 66. When wiring the power supply module, see section Power Supply Module on page 49.

![Figure 20 Screw Terminal Block on Motherboard](image)

The following numbers refer to Figure 20 above:
1 = Power supply terminals 10 ... 35 VDC, 24 VAC
2 = User port (RS-232 terminals)
3 = Analog signal terminals

**WARNING** Make sure that you connect only de-energized wires.

1. Unfasten the four cover screws and open the transmitter cover.
2. Insert the power supply wires and signal wires through the cable bushing in the bottom of the transmitter; see the grounding instructions in the previous sections.
3. Connect the analog output cables to terminals: Ch1+, Ch1-, Ch2+, Ch2-. Connect the RS-232 user port cables to terminals RxD, GND and TxD. For more information about the RS-232 connection refer to section Serial Line Communication on page 79.
4. When wiring the optional modules, see the corresponding section for instructions:
   - RS-422/485 Interface on page 57
   - Relays on page 56
   - Third Analog Output on page 54
   - LAN Interface on page 62
   - WLAN Interface on page 63
5. Connect the power supply wires to the connectors: **POWER 10 ... 35V+ 24V~ (+) and (-) terminals.** If you are using 24 VAC power supply, see the note below before connecting the supply wires.

6. Turn on the power. The indicator LED on the cover is lit continuously during normal operation.

7. Close the cover and fasten the cover screws. The transmitter is ready for use.

**Connections to a 24 VAC Power Supply**

Separate floating supply for each transmitter is recommended (see the upper part of Figure 21 on page 39). If you have to connect several transmitters or other instruments to one AC supply, the phase (~) must always be connected to the (+) connector of each transmitter (see the lower part of Figure 21).

**CAUTION**

**24 VAC POWER SUPPLY USE**

To prevent fire and/or damage, if either 24 VAC wire is grounded or connected to a "-", "0", or "GND" terminal of any other device, you must connect the same wire on the "-" terminal also on this instrument.
Figure 21 Connections to 24 VAC Power Supply
Probe Mounting

In humidity measurement and especially in calibration it is essential that temperature of the probe and measuring environment is the same. Even a small difference in temperature between the environment and the probe causes an error. As the curve below shows, if the temperature is +20 °C and the relative humidity 100 %RH, a difference of ±1 °C between the environment and the probe causes an error of ±6 %RH.

The graph below illustrates the measurement error at 100 %RH when the difference between the ambient and sensor temperature is 1 °C.

![Graph](image)

**Figure 22** Measurement Error at 100 %RH
General Instructions for Probes with a Cable

Mount the probes with a cable horizontally; this way, any water condensing on the tube cannot flow onto the sensor.

Figure 23  Horizontal Mounting of Probe

The following numbers refer to Figure 23 above:

1 = To be sealed
2 = To be insulated
3 = Insulate the cable
4 = Let the cable hang loosely. This prevents condensed water running to the probe along the cable.
When there is no alternative but to install the probe in the process vertically, the point of entry must be carefully insulated. The cable must also be allowed to hang loosely as this prevents any condensed water from running onto the probe along the cable.

![Diagram](image)

**Figure 24**  Vertical Mounting of Probe

The following numbers refer to Figure 24 above:

1 = To be sealed  
2 = Insulate the cable  
3 = To be insulated  
4 = Let the cable hang loosely. This prevents condensed water running to the sensor along the cable.

**NOTE** Please do not attach a heated probe (HMT337) to metal structures to avoid condensation problems caused by heat conduction along the metal.

If the process temperature is much higher than that of the environment, the whole probe and preferably plenty of cable must be inside the process. This prevents measuring inaccuracy caused by heat conduction along the cable.

When mounted on the side of a duct or channel, the probe must be inserted from the side of the duct. If this is not possible and the probe must be inserted from the top, the point of entry must be carefully insulated.

For Vaisala probe installation kits and some installation examples, see Appendix A on page 185.
HMT333 for Ducts and Tight Spaces

The HMT333 is a small size (ø = 12mm) general-purpose probe suitable for ducts and channels with the installation kit available from Vaisala.

The HMT333 provides for two measuring range options. The first probe version is equipped with a flexible cable and can be used when measuring in environments up to 80 ºC. The second version is suitable for measuring in environments up to 120 ºC.

See Appendix A on page 185 for the following probe installation kits for HMT333 and installation examples.

- Duct mounting kit
- Cable gland

HMT334 for High Pressure and Vacuum Applications

The HMT334 probe is for the dewpoint measurements in pressurized rooms and industrial processes. The probe is provided with a nut, a fitting screw and a sealing washer. Keep the fitting screw and the nut in place on the body of the probe during handling to prevent damage to the highly polished surface of the probe. Follow the instructions below to achieve a leak-tight assembly:

1. Remove the fitting screw from the nut and the probe.
2. Attach the fitting screw to the chamber wall with a sealing washer. Tighten the fitting screw into the threaded sleeve with a torque wrench. The tightening torque is 150 ± 10 Nm (110 ± 7 ft-lbs).
3. Insert the body of the probe into the fitting screw and attach the nut manually to the fitting screw so that the connection feels tight.
4. Mark both the fitting screw and the nut hex.
The following numbers refer to Figure 25 above:

1 = Tightening cone
2 = Nut
3 = Fitting screw, M22x1.5 or NPT 1/2"
4 = Sealing washer
5 = Probe; Ø12 mm

5. Tighten the nut a further 30° (1/12) turn or if you have a torque wrench tighten it with a torque of 80 ± 10 Nm (60 ± 7 ft-lbs).

**NOTE**
When re-tightening the nut after detachment the nut must be tightened without increased effort.

6. Clean and grease the tightening cone of the fitting screw after every tenth detachment. Change the sealing washer every time the fitting screw is detached. Use high-vacuum grease (for example Dow Corning) or similar grease.
The following numbers refer to Figure 27 above:

1 = Fitting screw
2 = Sealing washer
3 = Tightening cone
4 = Clean cotton stick

**CAUTION**

In pressurized processes it is essential to tighten the supporting nuts and screws very carefully to prevent loosening of the probe by the action of pressure.

**NOTE**

When installed in a process with a pressure differing from normal atmospheric pressure, please enter the pressure value of the process (in hPa or mbar) into the transmitter memory using the display/keypad option, using the serial line (see section PRES and XPRES on page 104), or using the Modbus protocol (see Configuration Registers on page 203).

**HMT335 for High Temperatures**

HMT335 is installed similarly as the HMT333 probe but without the supporting bar. Refer to Appendix A on page 185 for more information on the duct installation kit for HMT335.

To avoid incorrect humidity readings, the temperature differences between inside and outside of the duct must not be remarkable.
HMT337 for High Humidity Applications

The HMT337 is designed for environments where relative humidity is very high, near saturation. The warmed probe prevents the saturation of the sensor. An additional temperature probe is also available.

See Appendix A on page 185 for a presentation of the following probe installation kits for HMT337 with installation examples:

- Duct mounting kit
- Cable gland
- Pressure tight Swagelok connector
- Vaisala's Meteorological Installation Kit

The installation kits are available for both humidity and temperature probe.

Temperature Probe (Optional)

An additional temperature probe is available to measure the ambient temperature when the HMT337 (with probe warming) is used. The additional temperature probe allows you to measure other humidity quantities apart from dewpoint and mixing ratio. The temperature probe must be connected to the transmitter at the factory. Do not cut and re-connect the cable yourself.

You must install the additional temperature probe in the same measurement environment as the HMT337 probe. Make sure that heat does not transfer from the warmed probe to the temperature probe. For an example installation, refer to section Example of Installation Through Roof on page 191.

HMT338 for Pressurized Pipelines

Due to the sliding fit the HMT338 is easy to install into and remove from the pressurized process. The probe is especially suitable for the measurements in pipelines. See section Ball Valve Installation Kit for HMT338 on page 192.
Figure 28  HMT338 Probe

The following numbers refer to Figure 28 above:

1  =  Clasp nut, 24 mm hex nut
2  =  Fitting body, 27 mm hex head

The following two fitting body options are available:

- Fitting Body ISO1/2 solid structure
- Fitting Body NPT1/2 solid structure

Table 5  HMT338 Probe Dimensions

<table>
<thead>
<tr>
<th>Probe type</th>
<th>Probe Dimension</th>
<th>Adjustment Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>178 mm</td>
<td>120 mm</td>
</tr>
<tr>
<td>Optional</td>
<td>400 mm</td>
<td>340 mm</td>
</tr>
</tbody>
</table>

sealing with:
1. LOCTITE® No 542 + activ. No 7649 (t=-55...+150 °C)
2. MEGA-PIPE EXTRA No 7188 (t=-55...+170 °C)
3. PTFE tape (t=-60...+210 °C) NOTE: the tape does not lock the parts together. Therefore, use two fork spanners (hex 24 and 27 mm) for tightening and opening the clasp nut of the probe

Figure 29  Sealing of Fitting Body into Process
Tightening the Clasp Nut

1. Adjust the probe to a suitable depth according to the type of installation.
2. Tighten the clasp nut first manually.
3. Mark the fitting screw and the clasp nut.
4. Tighten the nut a further 50 -60º (ca. 1/6 turn) with a wrench. If you have suitable torque wrench, tighten the nut to max 45 ± 5 Nm (33 ± 4 ft-lbs).

Figure 30    Tightening the Clasp Nut

The following numbers refer to Figure 30 above:

1 = Probe  
2 = Clasp nut  
3 = Fitting screw  
4 = Pen

**CAUTION**
Take care not to damage the probe body. A damaged body makes the probe less tight and may prevent it from going through the clasp nut.

**CAUTION**
In pressurized processes it is essential to tighten the supporting nuts and screws very carefully to prevent loosening of the probe by the action of pressure.

**NOTE**
Take care not to over tighten the clasp nut to avoid difficulties when opening it.
NOTE
When installed in a process with a pressure differing from normal atmospheric pressure, please enter the pressure value of the process (in hPa or mbar) into the transmitter memory. You can enter the value using the display/keypad option, using the serial line (see section PRES and XPRES on page 104), or using the Modbus protocol (see Configuration Registers on page 203).

Optional Modules

Power Supply Module

The AC (mains) power connection may be connected to the power supply module only by an authorized electrician. A readily accessible disconnect device shall be incorporated in the fixed wiring.

Figure 31  Power Supply Module

The following numbers refer to Figure 31 above:

1 = Connect AC (mains) voltage wires to these terminals
2 = Grounding terminal
3 = In case the module is not installed in the factory: Connect wires from these terminals to the POWER 10 ... 35V 24V terminals of the motherboard.
4 = +
5 = -
Installation

1. Disconnect the power and open the transmitter cover.
2. Remove the protective plug from the cable gland and thread the wires. In case the power supply module is installed in the factory, continue with the step 5.
3. Attach the power module to the bottom of the housing with four screws. See the position in Figure 2 on page 22.
4. Connect the wires from the terminals of the power supply module marked with + and - to the terminals **POWER 10 ... 35 V 24V** on the motherboard of the transmitter.
5. Connect the AC mains voltage wires to the power supply module terminals marked with **N** and **L**.
6. Attach the grounding wire to the grounding terminal on the right-hand side of the transmitter.
7. Connect the power. The LED on the cover of the transmitter is lit continuously during normal operation.

**WARNING**
Do not detach the power supply module from the transmitter when the power is on.

**WARNING**
Do not connect the mains power to power supply module when it is not installed in the transmitter.

**WARNING**
Always connect the protective ground terminal.
Warnings

- Das Netzmodul darf nur von einem dazu befugten Elektriker angeschlossen werden.
- Trennen Sie das Netzmodul nicht vom Messwertgeber, wenn der Strom eingeschaltet ist.
- Verbinden Sie das Netzmodul nur mit der Spannungsquelle, wenn es im Messwertgeber HMT330 montiert ist.
- Das Erdungskabel muss zum Schutz immer angeschlossen sein.

Ce produit est conforme à la Directive relative à la Basse Tension (2006/95/EEC).
- Seul un électricien compétent est habilité à raccorder le module d’alimentation au secteur.
- Ne pas détacher le module d’alimentation du transmetteur lorsqu’il est en service.
- Ne pas raccorder le secteur au module d’alimentation lorsque celui-ci n’est pas installé dans le transmetteur HMT330.
- Toujours raccorder un bornier de protection à la terre.

Tämä tuote on pienjännitedirektiivin (2006/95/EEC) mukainen.
- Vaihtovirtaliitännän saa kytkeä tehonsyöttömoduuliin ainoastaan valtuutettu sähköasentaja
- Älä irrota tehonsyöttömoduulia lähettimestä, kun virta on kytkeytetty
- Älä kytke verkkovirtaa tehonsyöttömoduuliin, jos kyseistä moduulia ei ole asennettu HMT330 lähettimeen.
- Kytke aina maadoitusliittimet.

Denna produkt uppfyller kraven i direktivet om lågspänning (2006/95/EEC).
- Nätanslutningen (växelströmsanslutningen) får bara anslutas till strömförsörjningsmodulen av en behörig elektriker.
- Ta inte loss strömförsörjningsmodulen från mätaren när strömmen är på.
- Anslut inte strömförsörjningsmodulen till näten när den inte är installerad i HMT330-mätaren.
- Anslut alltid en skyddande jordningsplint.

Questo prodotto è conforme alla Direttiva sul basso voltaggio (2006/95/CEE).
- La conduttura elettrica può essere collegata al modulo di alimentazione elettrica soltanto da un elettricista autorizzato.
- Non staccare l’alimentazione elettrica dal trasmettitore quando è acceso.
- Non collegare la corrente elettrica al modulo di alimentazione elettrica se non è installato nel trasmettitore HMT330.
- Collegare sempre il morsetto protettivo a terra!
Dette produkt er i overensstemmelse med direktivet om lavspænding (2006/95/EØS).

- Netstromskoblingen til må kun tilsluttes strømforsyningsmodulet af en autoriseret elinstallator
- Strømforsyningsmodulet må ikke losges fra senderen, mens spændingen er sluttet til.
- Slut ikke netspændingen til strømforsyningsmodulet, når det ikke er installeret i HMT330-
  senderen
- Forbind altid den beskyttende jordklemme!

Dit product voldoet aan de eisen van de richtlijn 2006/95/EEG
(Laagspanningsrichtlijn).

- De stroom kan aan de stroomtoevoer module aangesloten worden alleen door een bevoegde
  monteur.
- Het is niet toegestaan de stroomtoevoer module van de transmitter los te koppelen wanneer de
  stroom aan is.
- Het is niet toegestaan de stroom aan de stroomtoevoer module aan te sluiten als deze niet in
  een HMT330-transmitter is gemonteerd.
- Altijd beschermend aardcontact aansluiten!

Este producto cumple con la directiva de bajo voltaje (2006/95/EEC).

- La conexión de la alimentación principal al módulo de alimentación sólo puede realizarla un
  electricista autorizado.
- No desenchufe el módulo de alimentación del transmisor cuando esté encendido.
- No conecte la alimentación principal al módulo de alimentación cuando no esté instalado en
  el transmisor HMT330.
- Conecte siempre el terminal de protección de conexión a tierra.


- Voolukaabli võib vooluallika mooduli külge ühendada ainult volitatud elektrik.
- Ärge ühendage vooluallika moodulit saatja küljest lahti, kui vool on sisse liilitatud.
- Ärge ühendage voolukaablit vooluallika mooduli külge, kui seda pole HMT330-tüüpi
  saatjasse paigaldatud.
- Ühendage alati kaitsev maandusklemm!

Ez a termék megfelel a Kisfeszültségű villamos termékek irányelvnek
(2006/95/EGK).

- A hálózati feszültséget csak féljogosított elektrotechnikus csatlakoztathatja a
  tápegységmodulra.
- A bekapsolt távadóról ne csatolja le a tápegységmodult.
- Ne csatlakoztassa a hálózati feszültséget a tápegységmodulhoz, ha az nincs beépítve a
  HMT330 távadóba.
- Feltétlenül csatlakoztasson földelő védőkapcsot!
Šis produktas atitinka direktyvą dėl žemos įtampos prietaisų (2006/95/EB).

- Elektros tinklą su energijos tiekimo moduliu sujungti gali tik igaliotas elektrikas.
- Niekada neišimkite energijos tiekimo modulio iš siųstuvo, kai maitinimas yra įjungtas.
- Jei energijos tiekimo modulis nėra įmontuotas HMT330 siųstuve, nejunkite jo į elektros tinklą.
- Visada prijunkite prie apsauginės įžeminimo jungties!

Šis produkts atbilst Zemsprieguma direktīvai (2006/95/EEC).

- Strāvas pieslēgumu var pieslēgt pie barošanas avota moduļa tikai autorizēts elektriķis.
- Neatvienot barošanas avota moduli no raidītāja, kad pieslēgta strāva.
- Nepievienot strāvu barošanas avota modulim, ja tas nav uzstādēts HMT330 raidītājā
- Vienmēr pievienot aizsargājošu izemētu terminālu!


- Napięcie zasilające powinno zostać podłączone do modułu zasilacza tylko przez wykwalifikowanego elektryka.
- Nie wolno odłączać modułu zasilacza od nadajnika, kiedy zasilanie jest włączone.
- Nie wolno podłączać napięcia zasilającego do modułu zasilacza, kiedy nie jest on zamontowany w nadajniku HMT330.
- Zawsze należy podłączać zabezpieczający zacisk uziemiający!


- Připojení síťového napájení k napájecímu modulu smí provádět pouze oprávněný elektrikář.
- Neodpojujte napájecí modul od snímače při zapnutém napájení.
- Nepřipojujte síťové napájení k napájecímu modulu, pokud není instalován ve snímači HMT330.
- Vždy zapojte ochrannou zemnicí svorku!
Galvanic Isolation of the Power Supply

If galvanic isolation of the power supply line from the output signals is needed, HMT330 can be ordered with optional galvanic isolation module. This module prevents harmful grounding loops.

**NOTE**

Galvanic isolation module is not needed when using the AC power supply module. Note also that these two modules are physically incompatible to be installed at the same time. If both modules are installed, there is no room to close the transmitter cover completely.

---

**Figure 32  Galvanic Isolation Module**

The following number refers to Figure 32 above:

1  =  Galvanic isolation module

**Third Analog Output**

---

**Figure 33  Third Analog Output**

The following numbers refer to Figure 33 above:

1  =  Flat cable pins
2  =  Screw terminals for signal line
3  =  DIP switches to select the output mode and range
Installation and Wiring

1. Disconnect the power. In case the analog output module is installed in the factory, continue with the step 4.
2. Open the transmitter cover and fasten the analog output module to the position for MODULE 2 with four screws. Refer to Figure 2 on page 22.
3. Connect the flat cable between the analog output module and the motherboard's connector for MODULE 2.
4. Take out the protective plug from the cable gland and thread the wires.
5. Connect the wires to the screw terminals marked with Ch+ and Ch-.
6. Select the current/voltage output by setting ON either of the switches 1 or 2.
7. Select the range by setting ON one of the switches 3 ... 7.

NOTE

Only one of the switches 1 ... 2 can be ON at a time.
Only one of the switches 3 ... 7 can be ON at a time.

<table>
<thead>
<tr>
<th>Channel 3</th>
<th>OFF</th>
<th>ON</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Selection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Current output selection, ON=Current output selected</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Voltage output selection, ON=Voltage output selected</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0...20 mA selection, ON= 0...20 mA selected</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4... 20 mA selection, ON= 4... 20 mA selected</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0...1 V selection, ON= 0...1 V selected</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0...5 V selection, ON= 0...5 V selected</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0...10 V selection, ON= 0...10 V selected.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For service use only, keep always in OFF position.</td>
</tr>
</tbody>
</table>

Figure 34 Third Analog Output Selection

8. Connect the power.
9. Select the quantity and scale the channel via the serial line or display/keypad, see section Analog Output Quantities on page 121. For testing the analog output, see section Analog Output Tests on page 123. For fault indication setting, see section Analog Output Fault Indication Setting on page 124.
Relays

HMT330 can be equipped with one or two configurable relay modules. Each module contains two configurable relays. See the contact ratings in section Technical Specifications of Optional Modules on page 176.

Installation and Wiring

1. Disconnect the power and open the transmitter cover. In case the relay-module is installed in the factory, continue with step 5.
2. Attach the relay module to the bottom of the housing with four screws. See the position in Figure 2 on page 22.
3. When the mains power is in use attach the grounding wire to the grounding terminal.
4. Connect the flat cable between the relay module and the MODULE 1 or MODULE 2 pins of the motherboard.
5. Take out the protective plug from the cable gland and thread the relay wires.
6. Connect the wires to the screw terminals: NO, C, and NC. Refer to section Selecting the Activation State of the Relay below.

CAUTION

For installations in the USA: If your transmitter has both the relay module and a LAN or WLAN module, the maximum voltage you are allowed to connect to the relay module is 50 V.

7. Connect the power and close the cover.

Selecting the Activation State of the Relay

The middlemost C terminal and either one of the terminals NO/NC must be connected. The polarity can be freely selected.

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO</td>
<td>Normally open</td>
</tr>
<tr>
<td>C</td>
<td>Common relay</td>
</tr>
<tr>
<td>NC</td>
<td>Normally closed</td>
</tr>
</tbody>
</table>

Relay NOT activated: C and NC outputs are closed, NO is open
Relay IS activated: C and NO outputs are closed, NC is open.

NOTE

For instructions on how to operate the relay (for example, selecting quantity for the relay output and setting the relay setpoints), see section Operation of Relays on page 125.
Figure 35  Relay Module

The following numbers refer to Figure 35 above:
1  =  Indication led for the relay 1 or 3
2  =  Relay test buttons
3  =  Flat cable pins
4  =  Indication led for relay 2 or 4

WARNING  The relay module may contain dangerous voltages even if the transmitter power has been disconnected. Before opening the transmitter you must switch off both the transmitter and the voltage connected to the relay terminals.

WARNING  Do not connect the mains power to relay unit without grounding the transmitter.

RS-422/485 Interface

The RS-422/485 interface enables communication between an RS-485 network and the HMT330 transmitter. The RS-485 interface is isolated and offers a maximum communications rate of 115 200 bits/s. (For maximum bus length of 1 km, use bit rate 19200 b/s or less.)

When selecting an RS-232 to RS-485 converter for the network, avoid self-powered converters, as they do not necessarily support the needed power consumption.

NOTE  RS-232 User Port on HMT330 main board cannot be used and connected when RS-485 module is connected. Service port operates normally.
Figure 36   RS-422/485 Module

The following numbers refer to Figure 36 above:

1 = Flat cable pins
2 = Selection switches
3 = Screw terminals for wiring

NOTE

The data lines on earlier versions of the RS-422/485 module are marked A and B instead of D1+ and D0-. When the line is idle, D1+ has positive voltage compared to D0-.

When connecting the module, be prepared to swap the D1+ and D0-wires if you have a communication problem.

Installation and Wiring

1. Disconnect the power. In case the RS-422/485-module is installed in the factory, continue with the item 4.
2. Open the transmitter cover and attach the RS-422/485 module to the bottom of the housing with four screws.
3. Connect the flat cable between the RS-422/485 module and the motherboard's pins MODULE1 (Communications).
4. Pull the network wirings through the cable gland.
5. Connect the twisted pair wires (1 or 2 pairs) to the screw terminals as presented in Table 6 below:

**Table 6  Connecting the Twisted Pair Wires to the Screw Terminals**

<table>
<thead>
<tr>
<th>Screw Terminal</th>
<th>Data Line (2-wire RS-485)</th>
<th>Data Line (4-wire RS-422/485)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(not connected)</td>
<td>Rx D0-</td>
</tr>
<tr>
<td>2</td>
<td>(not connected)</td>
<td>Rx D1+</td>
</tr>
<tr>
<td>3</td>
<td>Common</td>
<td>Common</td>
</tr>
<tr>
<td>4</td>
<td>D0-</td>
<td>Tx D0-</td>
</tr>
<tr>
<td>5</td>
<td>D1+</td>
<td>Tx D1+</td>
</tr>
</tbody>
</table>

To avoid problems in the RS-422/485 network, the Common terminal should be wired to the corresponding terminals of the other devices.

6. If you use RS-422 or RS-485 to connect just one HMT330 to a master computer, enable the internal termination of HMT330 by switching switches 1 and 2 ON. Make sure that the master's end of the line is also terminated (by using master's internal termination or with a separate terminator).

If you are connecting many transmitters to the same RS-485 bus, make sure that switches 1 and 2 are OFF and terminate the bus with separate terminators at both ends. This allows removing any transmitter without blocking the bus operation.

**NOTE**

If you use the internal termination of the transmitter at the end of the RS-485 bus (instead of using separate terminators) removing that transmitter will block the bus operation.

7. Use the bus type (4-wire/2-wire) to select the selection switch 3.

In 4-wire mode RS-485 master sends data to the HMT330 through terminals Rx D1+ and Rx D0- and receives data from HMT330 through terminals Tx D1+ and Tx D0-.
Figure 37  4-Wire RS-485 Bus

Table 7  4-Wire (Switch 3: On)

<table>
<thead>
<tr>
<th>RS-485 master</th>
<th>Data</th>
<th>HMT330</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tx D1+</td>
<td>→</td>
<td>Rx D1+</td>
</tr>
<tr>
<td>Tx D0-</td>
<td>→</td>
<td>Rx D0-</td>
</tr>
<tr>
<td>Rx D1+</td>
<td>←</td>
<td>Tx D1+</td>
</tr>
<tr>
<td>Rx D0-</td>
<td>←</td>
<td>Tx D0-</td>
</tr>
</tbody>
</table>
Figure 38 2-Wire RS-485 Bus

Table 8 2-Wire (Switch 3: Off)

<table>
<thead>
<tr>
<th>RS-485 master</th>
<th>Data</th>
<th>HMT330</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1+</td>
<td>↔</td>
<td>D1+</td>
</tr>
<tr>
<td>D0-</td>
<td>↔</td>
<td>D0-</td>
</tr>
</tbody>
</table>

8. When operating in communication mode RS-422, set both switches 3 and 4 to ON position (4-wire wiring is required for RS-422 mode).

9. Connect the power and close the cover.
LAN Interface

The optional LAN interface enables an Ethernet connection to the transmitter. The user can establish a virtual terminal session using a Telnet client program such as PuTTY or by using Modbus TCP protocol. When the LAN interface is in use, serial communication using the RS-232 User Port is disabled.

The LAN interface module must be installed at the factory (when ordering the transmitter), or by a Vaisala Service Center. Once installed, the module is automatically used by the transmitter. The physical connection to the network is made to the RJ45 connector on the LAN interface module, using a standard twisted pair Ethernet cable (10/100Base-T). Transmitters with the optional LAN interface are delivered pre-installed with a suitable cable and cable gland.

The LAN interface can use both static and dynamic network settings. If the interface is configured to use dynamic settings, the network where the LAN interface is connected must have a DHCP server that provides the settings.

The network configuration can be done using the optional display and keypad, or by using the service port. For instructions, see section LAN Communication on page 82. The LAN interface also provides a web configuration interface, which you can access by entering the IP address of the LAN interface in the address field of a web browser. See section Web Configuration for LAN and WLAN on page 89.

CAUTION
The LAN interface is designed to be used in trusted network environments (trusted corporate LAN or VPN-based connection over internet). Avoid connecting the transmitter directly to a public network because the device can be attacked by a malicious user through the network.

![LAN Interface Module Diagram](image)

Figure 39   LAN Interface Module

1 = Flat cable connector
2 = RJ45 connector with indicator LEDs for link and activity
WLAN Interface

The optional WLAN interface enables a wireless Ethernet connection (IEEE 802.11b) to the transmitter. The user can establish a virtual terminal session using a Telnet client program such as PuTTY or by using Modbus TCP protocol. When the WLAN interface is in use, serial communication using the RS-232 User Port is disabled.

The interface supports Wired Equivalent Privacy (WEP) and Wi-Fi Protected Access (WPA, WPA2). For WEP, 64 and 128 bit encryption is supported, with open system or shared key authentication. WPA is used in the Pre-Shared Key (PSK) mode, with either TKIP or CCMP (also known as AES) encryption.

Similarly to the LAN interface, the WLAN interface can use both static and dynamic network settings. If the interface is configured to use dynamic settings, the network where the WLAN interface is connected must have a DHCP server that provides the settings.

The WLAN interface also provides a web configuration interface, which you can access by entering the IP address of the WLAN interface in the address field of a web browser. See section Web Configuration for LAN and WLAN on page 89.

![WLAN Interface Module](image)

**Figure 40  WLAN Interface Module**

**CAUTION**

The WLAN interface is designed to be used in trusted network environments (trusted corporate LAN or VPN-based connection over internet). Avoid connecting the transmitter directly to a public network because the device can be attacked by a malicious user through the network.

**NOTE**

The default country setting for the WLAN interface is United States, which limits the operation to WLAN channels 1 ... 11. To enable additional channels (12 ... 14), you can change the country setting using the web configuration interface.
NOTE

The WLAN interface is not recommended for use with the HMT331 fixed probe model (for wall-mounted applications). The HMT331 short cable probe is designed to be used with the WLAN interface.

Attaching the WLAN Antenna

The WLAN interface module must be installed at the factory (when ordering the transmitter), or by a Vaisala Service Center. Before taking the transmitter into use, you must attach the antenna of the WLAN interface into the RP-SMA connector on the transmitter cover. The location of the antenna is shown in Figure 83 on page 181.

Data Logger Module

The optional data logger module extends the data storage for the measurement data. When the data logger is present, this storage is automatically used by the transmitter. The stored data can be browsed using the optional display module, and accessed through the serial connections. See sections Graphic History on page 68 and Data Recording on page 116.

The data logger module contains non-volatile flash memory providing 4 years and 5 months of storage for 4 parameters at a 10-second sampling interval. When the memory is full, the data recording will not stop. Instead, the oldest data is overwritten. For each parameter and observation period, the module stores the minimum and maximum values during the interval, as well a data trend value that is averaged from samples taken during the interval (see Table 9 on page 64).

<table>
<thead>
<tr>
<th>Observation Period</th>
<th>Period for Trend/Max/Min Calculations (Resolution)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 minutes</td>
<td>10 seconds</td>
</tr>
<tr>
<td>3 hours</td>
<td>90 seconds</td>
</tr>
<tr>
<td>1 day</td>
<td>12 minutes</td>
</tr>
<tr>
<td>10 days</td>
<td>2 hours</td>
</tr>
<tr>
<td>2 months</td>
<td>12 hours</td>
</tr>
<tr>
<td>1 year</td>
<td>3 days</td>
</tr>
<tr>
<td>4 years</td>
<td>12 days</td>
</tr>
</tbody>
</table>

The quantities that are logged are the same that have been selected for measurement using the display/keypad or the serial line. When taking the transmitter into use, verify that the desired quantities are selected. If you change the quantities later, the transmitter will start logging the new quantities, and stop logging the quantities that are no longer selected. Changing the quantities does not delete any measurement data that is
already in memory. However, the data of any removed quantity cannot be accessed unless the quantity is re-activated first.

The data logger module has a real time clock with a battery back-up. The clock has been set to the Coordinated Universal Time (UTC) at the factory, and its time cannot be set by the user. The data that is stored in the logger's memory is timestamped using the logger's clock.

When date and time are set on the transmitter, they are stored to the transmitter's memory as an offset from the time on the logger's clock. When browsing the stored data, the time offset is applied to the timestamps shown in the graphical history, and data outputted from the serial port. The timestamps in the data logger's memory remain as they were originally stored.

You can compensate for the clock drift (less than ±2 min/year) by setting the time on the transmitter. This updates the time offset used on the display and the serial port. You can set the time by using the keypad/display or the serial commands.

![Data Logger Module](0706-068)

**Figure 41**  Data Logger Module

After a reset or a power up, it will usually take at least 10 seconds before the data logger module is initialized. The instrument will not start up before the data logger module is ready.

The indicator LED on the module will blink green during normal operation. If the LED is lit in red color, there is a problem with the module. The transmitter will also indicate the problem by activating the "Internal error on add-on module" error. If the module is not operating correctly, the transmitter must be sent to Vaisala for maintenance.

The data logger module must be installed at the factory (when ordering the transmitter), or by a Vaisala Service Center. Once installed, the module is automatically used by the transmitter. When the module requires a new battery, the transmitter must be sent to Vaisala for maintenance.
8-Pin Connector

Figure 42 Pinout of the Optional 8-Pin Connector

Table 10 Wiring of the Optional 8-Pin Connector

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>White</td>
<td>Data out TX</td>
<td>D1+</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Brown</td>
<td>(Serial GND)</td>
<td>(Serial GND)</td>
<td>Signal GND (for both channels)</td>
</tr>
<tr>
<td>3</td>
<td>Green</td>
<td>-</td>
<td>-</td>
<td>Ch 2+</td>
</tr>
<tr>
<td>4</td>
<td>Yellow</td>
<td>-</td>
<td>-</td>
<td>Ch 1 +</td>
</tr>
<tr>
<td>5</td>
<td>Grey</td>
<td>Supply -</td>
<td>Supply -</td>
<td>Supply -</td>
</tr>
<tr>
<td>6</td>
<td>Pink</td>
<td>Supply +</td>
<td>Supply +</td>
<td>Supply +</td>
</tr>
<tr>
<td>7</td>
<td>Blue</td>
<td>Data in RX</td>
<td>D0-</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>Shield/Red</td>
<td>Cable shield</td>
<td>Cable shield</td>
<td>Cable shield</td>
</tr>
</tbody>
</table>
CHAPTER 4
OPERATION

This chapter contains information that is needed to operate this product.

Getting Started

Within a few seconds after power-up the LED on the cover of the transmitter is lit continuously indicating normal operation. If the data logger module is installed, the startup may take up to 18 seconds.

When using the optional display and turning the transmitter on the first time, the language selection menu window opens. Select the language with ▼▲ arrow buttons and press the SELECT button (the left-hand button).

Pressure has an effect on humidity calculations and accuracy. Therefore, accurate calculations can be achieved only when the ambient pressure is taken into consideration. For instructions on how to set the pressure, see section Pressure Compensation Setting on page 104.

Display/Keypad (Optional)

Basic Display

Display shows you the measurement values of the selected quantities in the selected units. You can select 1 ... 4 quantities for the numerical basic display (see section Changing Quantities and Units on page 100.)

1 = INFO shortcut button; see section Device Information on page 108

2 = GRAPH shortcut button; see section Graphic History on page 68

3 = Quantities selected for display

Figure 43 Basic Display
NOTE  From any view, even in the absence of an EXIT button, a four-second press on the right-hand function button takes you directly to the basic display.

Graphic History

The graphical display shows the data trend or min/max graph of the selected quantities, one at a time. The graph is updated automatically while measuring.

**Figure 44   Graphical Display**

**Trend graph**: Shows you a curve of average values. Each value is a calculated average over a period. See Table 11 below.

**Max/min graph**: Shows you the minimum and maximum values in a form of curve. Each point shows the absolute minimum and maximum observed during the time period represented by the data point. See Table 11 on page 68.

**Table 11   Periods for Trend and Max/Min Calculations**

<table>
<thead>
<tr>
<th>Observation Period</th>
<th>Period for Trend/Max/Min Calculations (Resolution)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 minutes</td>
<td>10 seconds</td>
</tr>
<tr>
<td>3 hours</td>
<td>90 seconds</td>
</tr>
<tr>
<td>1 day</td>
<td>12 minutes</td>
</tr>
<tr>
<td>10 days</td>
<td>2 hours</td>
</tr>
<tr>
<td>2 months</td>
<td>12 hours</td>
</tr>
<tr>
<td>1 year</td>
<td>3 days</td>
</tr>
<tr>
<td>4 year*</td>
<td>12 days</td>
</tr>
</tbody>
</table>

* The maximum logging period of the data logger module (available when data logger module is installed)

Use the following functions in the graphical display:

- Press the **NEXT** button to change between the trend graph and max/min graph for the quantities selected for display.
- Press the **EXIT** button to return to the basic display.
- Press the ▼▲ arrow buttons to zoom in and out in the graph window.
- Press the ◄► arrow buttons move the cursor (vertical bar) along the time axis. The cursor mode allows you to observe individual measuring points. The numerical value at the cursor position is shown at the left upper corner. The right upper corner shows the time from the present to the chosen moment (without the logger module), or the date and time at the cursor position (when the logger module is installed).

- If the optional data logger module is installed, you can scroll the cursor off the screen to move to a new point on the time axis. The new date will be displayed, and the cursor will be centered at the date where the cursor scrolled off the screen.

![Graphical Display with Data Logger](image)

**Figure 45** Graphical Display with Data Logger

If the data logger module is installed, you can move quickly on the time axis: zoom out, move the cursor, and zoom back in.

The time that is shown below the graph is adjusted with the current time offset of the transmitter. If you change the transmitter's date and time setting, the displayed timestamps in the history graph change accordingly. For an explanation of the effect of changing the date and time manually, see section Data Logger Module on page 64.

<table>
<thead>
<tr>
<th>Table 12</th>
<th>Graph Information Messages in Cursor Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Message</strong></td>
<td><strong>Interpretation</strong></td>
</tr>
<tr>
<td>Power outage</td>
<td>Power failure (marked also with dashed vertical line)</td>
</tr>
<tr>
<td>No data</td>
<td>Quantity has not been selected for the display</td>
</tr>
<tr>
<td>System error</td>
<td>General device or power supply problem</td>
</tr>
<tr>
<td>T meas. error</td>
<td>Temperature measurement/sensor failure</td>
</tr>
<tr>
<td>RH meas. error</td>
<td>Humidity measurement/sensor failure</td>
</tr>
<tr>
<td>Adj. mode active</td>
<td>Adjustment mode active (data recorded in the adjustment mode is not displayed)</td>
</tr>
</tbody>
</table>

A question mark after time tells you that at least one power failure (dashed vertical line) has occurred after the chosen moment. In this case, the exact time difference between the present and the cursor position is not exactly known. If the data logger module is installed, the time is known and the question marks are not present.
Menus and Navigation

You can change settings and select functions in the menus.

1. Open the **Main Menu** by pressing any of the ▼▲◄► arrow buttons in the basic (numeric) display mode.
2. Move in the menus by using the ▲▼ arrow buttons.
3. Open a submenu with ► button.
4. Press ◄ to return to the previous level.
5. Function button **EXIT** returns you back to the basic display.

![Figure 46 Main Menus](image)

Some menu items, such as **Purge** in the **Measuring** menu, are only shown if supported by the transmitter and the installed options.
Changing the Language

1. Go back to the basic display by keeping the right-hand button pressed for four seconds.

2. Open the Main Menu by pressing any of the ▼▲◄► buttons.

3. Scroll to the System menu option, and press the ► button. The menu option is indicated with the wrench symbol.

4. Scroll to the Language menu option, and press the left-hand button. The menu option is indicated with the flag symbol.

5. Select the language with the ▼▲ buttons, and confirm the selection by pressing the left-hand button.

6. Press the right-hand button to exit to the basic display.

Rounding Setting

Round off one decimal by using the Rounding function. The default setting is rounding on. Rounding has no effect on quantities without decimals.

1. Open the Main Menu by pressing any of the ▼▲◄► arrow buttons.

2. Select Display and confirm by pressing the ► arrow button.

3. Select Rounding and press ON/OFF button.

4. Press EXIT to return to the basic display.

Display Backlight Setting

As a default the display backlight is always on. In the automatic mode the backlight stays on for 30 seconds from the last press of any button. When pressing any button, the light turns on again.

1. Open the Main Menu by pressing any of the ▼▲◄► arrow buttons.

2. Select Display, press the ► arrow button.

3. Select Backlight, press the CHANGE button.

4. Select On/Off/Automatic, press the SELECT button.

5. Press EXIT to return to the basic display.
Display Contrast Setting

Display contrast is automatically adjusted based on the ambient temperature. However, depending on the installation location and viewing direction, it may be necessary to fine-tune the contrast manually.

Using Display/Keypad
1. Open the Main Menu by pressing any of the ▼▲◄► arrow buttons.
2. Select Display, press the ►arrow button.
3. Select Contrast, press the ADJUST button.
4. Adjust the contrast by pressing the ◄► arrow buttons.
5. Press OK and EXIT to return to the basic display.

Using Serial Line

Use the serial line command CON to view or set the display contrast.

CON [xxx]<cr>

where
xxx = Contrast value for display. Recommended range -9 ... 9, default 0. Negative values make screen lighter, positive values make it darker.

Example (view current contrast setting):

>con
Contrast : 0
>

Example (set contrast to 5):

>con 5
Contrast : 5
>
Keypad Lock (Keyguard)

This function locks the keypad and prevents unintentional key presses.
1. Keep pressing the left-hand function button for 4 seconds to lock the keypad (at any display).
2. To unlock the keypad, press the OPEN button for 4 seconds.

Menu PIN Lock

You can prevent unauthorized changes of the device settings by activating the menu PIN lock. When this function is activated, the basic display, graphical view, and device information displays are available, but access to the menus is locked. The key symbol indicates the activation of this feature.

1. Open the Main Menu by pressing any of the ▼▲◄► arrow buttons.
2. Select System, press the ►arrow button.
3. Select Menu PIN, press the ON button.
4. Enter a PIN code by using the ▼▲arrow buttons. Press OK to confirm the setting. Now the PIN lock is on and a key symbol is shown in a display.
5. Press EXIT to return to the basic display. Returning to the menu is possible only by entering the correct PIN code.

When you want to turn off the PIN lock, go to the menu by giving the PIN code and select System, Menu PIN, press OFF button.

In case you have forgotten the PIN code, open the transmitter cover and press the ADJ button once. Wait for a few seconds and the adjustment menu opens. Select Clear menu PIN, press CLEAR.

NOTE

You can also disable the keypad completely with serial command LOCK. See section Locking Menu/Keypad Using Serial Line on page 111.
Factory Settings

Use the display/keypad to restore the factory settings. This operation does not affect the adjustments. Only settings available in the menus are restored.

1. Press any of the arrow buttons to open the Main Menu.
2. Select System by pressing the ► arrow button.
3. Select Factory settings and press the REVERT button to confirm your selection. Press the YES button to reset all settings to the factory defaults.

See section General Settings on page 99 for a description of the other menu options.

Configuring Display Alarms

The Display Alarm feature provides two independently configurable alarms for transmitters with the display/keypad option. Each alarm tracks a selected quantity, with freely configurable limit values. Each alarm also has a configurable hysteresis value to prevent unnecessary triggering when the measurement fluctuates around an alarm limit. The alarms can be configured for any quantity supported by the transmitter. The configuration of the Display Alarms can only be done using the display/keypad option.

You can have the alarm activate inside or outside the specified range by setting the limits correctly:

- To have the alarm activate when the measured quantity is outside the specified range, set the Act. above limit higher than the Act. below limit.
- To have the alarm activate when the measured quantity is inside the range, set the Act. above limit lower than the Act. below limit.

The alarm limits are shown on the graph display as thicker dotted lines. When a display alarm is activated, the automatic scaling of the graph display always keeps the limits in view.
When an alarm is activated, an alarm note is displayed on the display, and the lights of the display will blink. If the data logger module is installed, the alarm note includes the time and date of the alarm.

Multiple alarms can be active at the same time; the alarm that was triggered first will be shown on the display. The next active alarm is revealed when the currently shown alarm is acknowledged by pressing the OK button.

Activated alarms are only shown on the screen; there are no alarm messages output to the serial line. After an alarm has been acknowledged, you must refer to the data graphs to see when the measured quantities have exceeded the limits. You may use the optional relay outputs as alarm outputs by configuring them separately; see section Setting Relay Outputs on page 129.

Using Display/Keypad

1. Enter the Main Menu by pressing an arrow key on the keypad.
2. Use the arrow keys to select Display, followed by Alarms, to open the Display Alarms menu. The Display Alarms menu shows the currently enabled and disabled alarms.
3. Use the arrow keys to select an alarm to configure. The alarm editing page opens.

**NOTE**

Changes you do on the alarm editing page will take effect immediately, and may cause an alarm to appear on the screen.

4. To select a quantity for the alarm, press the **Change** button and select the quantity from the list.

5. To modify or remove the alarm limit values, move the selection over the **Act. above** or **Act. below** field and press the **Set** button. You will be prompted to **Modify** or **Remove** the value.

6. Set a suitable **Hysteresis** value to prevent the alarm from being triggered unnecessarily by small measurement changes that pass the alarm limit repeatedly.

7. Set or clear the **Alarm enable** checkbox to enable or disable the alarm.

8. Press the **Exit** button to leave the alarm configuration screen and return to the basic view.
Using Serial Line

Use the serial line command **ALSEL** to view or set the display alarms.

**ALSEL [quantity1 quantity2]<cr>**

where

quantity1 = Quantity for display alarm 1. You can set any quantity available on your transmitter; see Table 3 on page 19 and Table 4 on page 19. In addition to quantities, you can also select the following:

- **FAULT** – Alarm for device errors
- **ONLINE** – Alarm for sensor operations that freeze the measurement output (for example, chemical purge).

quantity2 = Quantity for display alarm 2. Options are the same as for quantity1.

Example (view current display alarm settings):

```
> alsel ?
A1 RH above: 80.00 %RH
A1 RH below: -
A1 RH hyst : 1.00 %RH
A1 RH enabl: ON
A2 T above: 40.00 'C
A2 T below: -
A2 T hyst : 1.00 'C
A2 T enabl: ON
```

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>above</td>
<td>If specified, the alarm goes off when the quantity value rises above the exact value of this setpoint. However, if above &lt; below, the alarm goes off at (above + hyst) and (below – hyst) instead. Cannot be set for fault and online alarms.</td>
</tr>
<tr>
<td>below</td>
<td>If specified, the alarm goes off when the quantity value decreases below the exact value of this setpoint. However, if above &lt; below, the alarm goes off at (above + hyst) and (below – hyst) instead. Cannot be set for fault and online alarms.</td>
</tr>
<tr>
<td>hyst</td>
<td>Distance from setpoint amount of extra retraction needed in order to regenerate alarm on the next crossing of the setpoint. Cannot be set for fault and online alarms.</td>
</tr>
<tr>
<td>enabl</td>
<td>Enable (ON) or disable (OFF) the display alarm.</td>
</tr>
</tbody>
</table>
Example (set Tdf and T as display alarm quantities and configure the alarms as prompted):

```
> alsel tdf t
A1 Tdf  above: 80.00 'C ? 0
A1 Tdf  below: - ?
A1 Tdf  hyst : 1.00 'C ?
A1 Tdf  enabl: ON ?
A2 T    above: 40.00 'C ? 30
A2 T    below: - ?
A2 T    hyst : 1.00 'C ?
A2 T    enabl: ON ?
>
```

MI70 Link Program for Data Handling

MI70 Link is a support program that enables you to handle the measurement data of your Vaisala transmitter using a Windows PC. Using the MI70 Link you can, for example:

- Monitor the transmitter’s measurement readings directly using the real-time window function.
- Transfer recorded data from the main transmitter memory in numeric or graphical format, for further use in a spreadsheet program (such as Microsoft Excel) or virtually any other application. Note that the maximum amount of data points that can be downloaded in one transfer is 65000.

To use the MI70 Link program, you must connect your Windows PC to the service port of the transmitter with a serial or USB cable. The MI70 Link program, and the optional connection cables, are available from Vaisala. See section Spare Parts and Accessories on page 178.

Follow the steps below to connect your transmitter and start using the MI70 Link:

1. Connect your PC to the service port of the transmitter. Refer to section Service Port Connection on page 81.
2. Check that the HMT330 is powered.
3. Start the MI70 Link program.
4. Start using the program. There is usually no need to select a COM port manually, the MI70 Link software can detect it automatically.

**NOTE**

For instructions on using the MI70 Link, see the program’s online help.
Serial Line Communication

Connect the serial interface by using either the User Port or the Service Port.

For permanent interfacing to host system, use the User Port. You can change the serial settings and operate in RUN, STOP, SEND, POLL, and Modbus modes.

For temporary connections, use the Service Port. The Service Port is always available with fixed serial settings.

![Service Port Connector and User Port Terminal on Motherboard](image)

**Figure 51** Service Port Connector and User Port Terminal on Motherboard

The following numbers refer to Figure 51 above:

1  =  Service port connector
2  =  User port terminals
User Port Connection

Use a suitable serial cable between the user port RxD, GND and TxD screw terminals and the PC serial port, see Figure 52 below.

Table 14 Default Serial Communication Settings for the User Port

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bauds</td>
<td>4800</td>
</tr>
<tr>
<td>Parity</td>
<td>Even</td>
</tr>
<tr>
<td>Data bits</td>
<td>7</td>
</tr>
<tr>
<td>Stop bits</td>
<td>1</td>
</tr>
<tr>
<td>Flow control</td>
<td>None</td>
</tr>
</tbody>
</table>

Figure 52 Connection Example between PC Serial Port and User Port

Connections to pins 4, 6, 7 and 8 on PC serial port are required only if you are using software requiring hardware handshaking.

User Port Operating Modes

When the transmitter is powered up, it will behave according to its configured operating mode:

- In STOP mode, the transmitter outputs the software version and the command prompt (if echo is on).
- In RUN mode a measurement output starts immediately.
- In SEND mode one measurement message is printed and command prompt is displayed (if echo is on).
- In POLL or Modbus mode, the transmitter does not output anything after power-up.

For a description of the modes, see section SMODE on page 114.

NOTE RS-232 User Port cannot be used when a communication module (LAN, WLAN, or RS-422/485 interface) has been installed.
Service Port Connection

Connection Cables

To connect to the service port, you need a suitable cable with an RJ45 connector. Depending on the connections of your PC, you can either use the Serial Connection Cable (optional accessory 19446ZZ) or the USB-RJ45 Serial Connection Cable (optional accessory 219685). The USB cable enables you to connect the transmitter to a PC via a standard type A USB port. Note that the USB cable does not enable high speed data transfer, since the bit rate is limited by the serial interface of the service port.

Installing the Driver for the USB Cable

If you have not used the Vaisala USB cable before, install the driver before attempting to use the cable. When installing the driver, you must acknowledge any security prompts that may appear.

1. Check that the USB service cable is not connected. Disconnect the cable if you have already connected it.
2. Insert the media that came with the cable, or download the latest driver from www.vaisala.com.
3. Execute the USB driver installation program (setup.exe), and accept the installation defaults.
4. After the driver has been installed, connect the USB service cable to a USB port on your PC. Windows will detect the new device, and use the driver automatically.
5. The installation has reserved a COM port for the cable. Verify the port number, and the status of the cable, using the Vaisala USB Instrument Finder program that has been installed in the Windows Start menu.

Windows will recognize each individual cable as a different device, and reserve a new COM port. Remember to use the correct port in the settings of your terminal program.
Using the Service Port

1. Unfasten the screws on the transmitter cover, and open the transmitter.

2. Connect the desired cable (serial interface cable or USB cable) to your PC and the service port connector on the transmitter. For the location of the service port, refer to Figure 51 on page 79.

3. Open a terminal program and set the communication settings as follows:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bauds</td>
<td>19200</td>
</tr>
<tr>
<td>Parity</td>
<td>None</td>
</tr>
<tr>
<td>Data bits</td>
<td>8</td>
</tr>
<tr>
<td>Stop bits</td>
<td>1</td>
</tr>
<tr>
<td>Flow control</td>
<td>None</td>
</tr>
</tbody>
</table>

   For a detailed explanation of using a terminal program, see section Terminal Program Settings on page 90.

4. Power-up the HMT330.

LAN Communication

To enable LAN communication, a LAN or WLAN interface must be physically connected to the network, and the networking settings must be suitable for your network. For a description of interfaces, see sections LAN Interface on page 62 and WLAN Interface on page 63.

The LAN and WLAN interfaces both operate by accessing the serial interface (User Port) of the transmitter. All commands and protocols that are available using the serial interface are available through the LAN and WLAN interfaces; refer to section List of Serial Commands on page 93. For instructions on how to connect using a terminal program, see section Terminal Program Settings on page 90.
IP Configuration

The IP settings of the LAN and WLAN interfaces are described in Table 16. The current settings can be viewed on the serial line or using the device information display; see section Device Information on page 108.

Table 16  IP Settings for the LAN and WLAN Interfaces

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic configuration</td>
<td>If enabled, the transmitter will retrieve its network settings (including the IP Address) from a server in the network. If disabled, static network settings are used instead.</td>
</tr>
<tr>
<td>(DHCP)</td>
<td></td>
</tr>
<tr>
<td>Web configuration</td>
<td>If enabled, the settings of the interface can be changed using a web browser. The configuration page can be accessed by browsing to the IP address of the transmitter.</td>
</tr>
<tr>
<td>IP Address</td>
<td>The four part network ID of the transmitter. Must be set manually if automatic configuration is not used.</td>
</tr>
<tr>
<td></td>
<td>Example value: 192.168.0.222</td>
</tr>
<tr>
<td>Netmask</td>
<td>Used together with the IP address to determine which network the transmitter is a part of. Must be set manually if automatic configuration is not used.</td>
</tr>
<tr>
<td>Gateway</td>
<td>IP address of the server that enables the transmitter to access other networks. Must be set manually if automatic configuration is not used.</td>
</tr>
<tr>
<td></td>
<td>Example value: 192.168.0.1</td>
</tr>
<tr>
<td>MAC</td>
<td>The MAC address is the unique hardware address of the LAN or WLAN interface. Cannot be changed.</td>
</tr>
</tbody>
</table>
**Using Display/Keypad**

You can configure the IP settings of the LAN and WLAN interfaces using the display/keypad as follows:

1. Press any of the arrow buttons to open the **Main Menu**.
2. Press the ► arrow button to select **Interfaces**.
3. Press ► arrow button to select **Network settings**. There will be a delay as the transmitter refreshes the network information.
4. You are now in the **Network Interface** menu. Selecting the **IP configuration** option opens the IP configuration menu.

![Figure 53 Network Interface Menu](image)

The **Network Interface** menu also allows you to configure the **Communication Protocol**, enable or disable the **Web configuration** option, or **Disconnect all** users that are currently accessing the LAN or WLAN interface.

5. In the IP configuration menu, select **Automatic configuration (DHCP)**, or enter the **IP address**, **Netmask** and **Gateway** manually. If automatic configuration is enabled, manual configuration cannot be done.

![Figure 54 IP Configuration Menu](image)

To enter a value manually, use the ▲▼ arrow buttons to select the parameter to change, and press **Change**. A cursor will appear in the first digit. Move the cursor using the ◄► arrow buttons, and change the value under the cursor using the ▲▼ arrow buttons. Confirm the selection by pressing **OK**.

6. After configuring the desired parameters, press **EXIT** to apply the changes and return to the basic display.
Using Serial Line

Use the serial line command **NET** to view or set the network settings for the LAN and WLAN interfaces. You can also refresh the network information or disconnect all active connections.

**NET [REFRESH] [DISCONNECT] [DHCP WEB] [DHCP IP SUBNET GATEWAY WEB]<cr>**

where

**REFRESH** = Updates the network information and displays it
**DISCONNECT** = Disconnects all current sessions
**DHCP** = ON or OFF. Enables or disables the automatic IP configuration.
**WEB** = ON or OFF. Enables or disables the Web Configuration page.
**IP** = The four part network ID of the transmitter. Must be set manually if automatic configuration is not used.
**SUBNET** = Used together with the IP address to determine which network the transmitter is a part of. Must be set manually if automatic configuration is not used.
**GATEWAY** = IP address of the server that enables the transmitter to access other networks. Must be set manually if automatic configuration is not used.

Examples:

**>net refresh**
OK
DHCP : OFF
IP address : 192.168.0.101
Subnet mask : 255.255.255.0
Default gateway : 192.168.0.1
Web config. : OFF
MAC address : 00:40:9d:2c:d2:05
Status : Not connected
>

**>net on off**
DHCP : ON
IP address : 192.168.0.104
Subnet mask : 255.255.255.0
Default gateway : 192.168.0.1
Web config. : OFF
MAC address : 00:40:9d:2c:d2:05
Status : Connected
OK
>
Wireless LAN Configuration

The settings of the WLAN interface are described in Table 17. The current settings can be viewed on the serial line or using the device information display; see section Device Information on page 108.

- CCMP encryption is called AES in some networking products.
- The WLAN interface supports both WPA and WPA2 (also known as 802.11i) security when either WPA-PSK mode is selected.
- If your WLAN network is using some other security method than listed below, you must set up a temporary WLAN network with any of these settings and then use the web configuration to set WLAN security settings for the actual network. See section Web Configuration for LAN and WLAN on page 89.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSID</td>
<td>The service set identifier (that is, network name) of the wireless network to connect to. 1 ... 32 characters.</td>
</tr>
<tr>
<td>Security type</td>
<td>The security type of the wireless network. The options are:</td>
</tr>
<tr>
<td></td>
<td>OPEN</td>
</tr>
<tr>
<td></td>
<td>OPEN/WEP</td>
</tr>
<tr>
<td></td>
<td>WPA-PSK/TKIP</td>
</tr>
<tr>
<td></td>
<td>WPA-PSK/CCMP</td>
</tr>
<tr>
<td></td>
<td>All other choices except OPEN require a security key; see below.</td>
</tr>
<tr>
<td>Security key</td>
<td>The encryption key or passphrase that is used with an encrypted network.</td>
</tr>
</tbody>
</table>
Using Display/Keypad

You can configure the Wireless LAN settings using the display/keypad as follows:

1. Press any of the arrow buttons to open the Main Menu.
2. Press the ► arrow button to select Interfaces.
3. Press the ► arrow button to select Network settings. There will be a delay as the transmitter refreshes the network information.
4. Press the ► arrow button to select Wireless LAN settings.

Figure 55 Wireless LAN Settings

5. The Name entry on the page shows the SSID of the currently selected wireless network. To change the SSID, press the SET button. Use the ▲▼ arrow buttons to change the character under the cursor, and ◄► arrow buttons to move the cursor. Press the OK button when done.

Figure 56 Entering Network SSID

6. To change the currently selected Network type, select the Type entry and press the Change button. Select the new type from the list and press the Select button.

Figure 57 Selecting the Wireless Network Type
7. If you have selected an encrypted network type (WEP or WPA), you must enter the security key to be used. Select the **Key/passphrase** entry and press the **Set** button. Enter the key in the same way as the SSID, and press the **OK** button. With the WEP encryption you must enter the encryption key in hexadecimal (10 hexdecimals for 64-bit encryption or 26 hexadecimals for 128-bit encryption). A WPA key must be 8 … 63 ASCII characters.

8. After setting the wireless network parameters, press the **Exit** button in the **Wireless LAN Settings** menu. You will be asked to confirm the new settings. Note that when new settings are saved, all currently active WLAN connections are disconnected.

### Using Serial Line

Use the serial line command **WLAN** to view or set the wireless network settings. If you set an encrypted network type, you will be asked to enter the security key. With the WEP encryption you must enter the encryption key in hexadecimal (10 hexdecimals for 64-bit encryption or 26 hexadecimals for 128-bit encryption) or with plain ASCII characters (5 characters for 64-bit encryption or 13 characters for 128-bit encryption). A WPA key must be 8 … 63 ASCII characters.

**WLAN [SSID TYPE]<cr>**

where

SSID = Network name in 1 … 32 characters

TYPE = Security type of the wireless network. The options are:

- OPEN
- OPEN/WEP
- WPA-PSK/TKIP
- WPA-PSK/CCMP

Examples:

```
>wlan ?
Network SSID : WLAN-AP
Type : OPEN
>

>wlan accesspoint wpa-psk/tkip
Network SSID : accesspoint
Type : WPA-PSK/TKIP
WPA-PSK phrase ? thequickbrownfox
Save changes (Y/N) ? y
OK
>
```
Communication Protocol

When a connection is established via the LAN or WLAN interface, the session has the same communication mode, run interval, poll address and echo settings as the serial port (User Port) session would have.

These settings can be changed using the display/keypad, using the serial line (User Port or Service Port), or on-the-fly during a Telnet session.

The display menu path to the Communication Protocol settings is:
Main Menu ► Interfaces ► Network Interface ► Communication Protocol.

The commands for changing the settings are SMODE, INTV, ADDR, and ECHO.

Web Configuration for LAN and WLAN

The LAN and WLAN interfaces both have a web configuration page that is accessible using a browser. If you have not disabled the page from the network settings, you can access it with a web browser at the IP address of the interface. You can check the currently assigned IP address of the interface from the device information screens (see Device Information on page 108), or from the serial line by issuing the net ? command.

When accessing the web configuration page, you must first log in.

Username: user
Password: vaisala

The web configuration page provides similar network configuration options as the serial line and the display/keypad. It also has additional options for advanced users. For example, there are more options for securing the wireless network.

If these additional options are used, they will appear as custom configurations when viewed from the serial line or the display/keypad.
Figure 58  Web Configuration Interface for LAN

Terminal Program Settings

The instructions below describe how to connect to the HMT330 using the PuTTY terminal application for Windows. Perform the necessary cabling and configuration of the transmitter before following the instructions.

PuTTY is available for download at www.vaisala.com.

NOTE
PuTTY cannot be used to access the transmitter through the User Port if the transmitter is configured to use the Modbus protocol. However, you can always use PuTTY to access the transmitter through the Service Port.

Opening a Serial/USB connection

1. Power up the HMT330 and start the PuTTY application.
2. Select the Serial & USB settings category, and check that the correct COM port is selected in the **Serial or USB line to connect to** field. Change the port if necessary.

   If you are using a Vaisala USB cable, you can check the port that it uses by clicking the **USB Finder...** button. This opens the *Vaisala USB Instrument Finder* program that has been installed along with the USB drivers.

3. Check that the other serial/USB line settings are correct for your connection, and change if necessary. The default settings (shown in Figure 59 on page 91) are used by the Service Port of the HMT330.
4. Click the **Open** button to open the connection window and start using the serial line.

   If PuTTY is unable to open the serial port you selected, it will show you an error message instead. If this happens, restart PuTTY and check the settings.

### Opening a Telnet session (LAN/WLAN)

**NOTE**

The instructions below assume that the LAN/WLAN interface on the transmitter is correctly configured and the network connection is already done.

1. Power up the instrument and start the PuTTY application. If your transmitter acquires a network address using DHCP, wait for a minute for this to complete, then verify the address from the transmitter.
2. In the Session window, select the **Telnet** connection type.
3. Enter the IP address of your transmitter in the **Host Name (or IP address)** field. Use the default Telnet port **23**.
4. Click the **Open** button to open the connection window and start using the Telnet session.

If PuTTY is unable to connect the IP address you entered, it will show you an error message instead. If this happens, check the IP address and the connections, restart PuTTY, and try again.
List of Serial Commands

All commands can be issued either in uppercase or lowercase. In the command examples, the keyboard input by the user is in **bold** type.

The notation <cr> refers to pressing the carriage return (Enter) key on your computer keyboard. Enter a <cr> to clear the command buffer before starting to enter commands.

In the tables below, the **bold** text in the brackets is the default setting.

### Table 18 Measurement Commands

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>Start the continuous outputting</td>
</tr>
<tr>
<td>S</td>
<td>Stop the continuous outputting</td>
</tr>
<tr>
<td>SEND [0 ... 255]</td>
<td>Output the reading once</td>
</tr>
<tr>
<td>DSEND</td>
<td>Output the reading once from all connected transmitters (in STOP or POLL mode)</td>
</tr>
</tbody>
</table>

### Table 19 Communication Commands

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTV [0 ... 255 S/MIN/H]</td>
<td>Set the continuous output interval (for RUN mode)</td>
</tr>
<tr>
<td>SMODE [STOP/SEND/RUN/POLL/MODBUS]</td>
<td>Set the serial interface mode</td>
</tr>
<tr>
<td>SDELAY</td>
<td>View or set user port (RS232 or RS485) answer minimum delay</td>
</tr>
<tr>
<td>SERI [baud p d s]</td>
<td>User Port settings (Default: 4800 E 7 1) baud: 300 ... 115200</td>
</tr>
<tr>
<td>ADDR [0 ... 255]</td>
<td>Set the transmitter address (for POLL and MODBUS modes)</td>
</tr>
<tr>
<td>NET</td>
<td>View or set networking parameters for LAN and WLAN interfaces</td>
</tr>
<tr>
<td>WLAN</td>
<td>View or set wireless network parameters for WLAN interface</td>
</tr>
<tr>
<td>OPEN [0 ... 255]</td>
<td>Open a temporary connection to a POLL mode device</td>
</tr>
<tr>
<td>CLOSE</td>
<td>Close the temporary connection (Back to POLL mode)</td>
</tr>
</tbody>
</table>

### Table 20 Formatting Commands

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FORM</td>
<td>Set the output format of SEND and R commands</td>
</tr>
<tr>
<td>TIME</td>
<td>Set the time</td>
</tr>
<tr>
<td>DATE</td>
<td>Set the date</td>
</tr>
<tr>
<td>FTIME [ON/OFF]</td>
<td>Add time to SEND and R outputs</td>
</tr>
<tr>
<td>FDATE [ON/OFF]</td>
<td>Add date to SEND and R outputs</td>
</tr>
<tr>
<td>FST [ON/OFF]</td>
<td>Add the state of probe heating and chemical purge in connection with SEND and R commands</td>
</tr>
<tr>
<td>SCOM</td>
<td>Assign a new command name that works like the SEND command</td>
</tr>
<tr>
<td>UNIT</td>
<td>Select the metric or non-metric output units</td>
</tr>
</tbody>
</table>
### Table 21  Data Recording Commands

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIR</td>
<td>Display recorded files</td>
</tr>
<tr>
<td>PLAY [0 ... 28] [START END]</td>
<td>Output recorded data file. Start and end times can only be specified if the data logger module is installed. The times must be given in the following format: yyyy-mm-dd hh:mm:ss</td>
</tr>
<tr>
<td>DSEL</td>
<td>Select data recording and display quantities (1 ... 4).</td>
</tr>
<tr>
<td>DELETE</td>
<td>Delete all data files, including the memory of the optional data logger module</td>
</tr>
<tr>
<td>UNDELETE</td>
<td>Recover the deleted files that have not been overwritten</td>
</tr>
</tbody>
</table>

### Table 22  Chemical Purge Commands

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUR</td>
<td>Set the automatic chemical purge</td>
</tr>
<tr>
<td>PURGE</td>
<td>Start the manual chemical purge</td>
</tr>
<tr>
<td>RGLIMIT [ON/OFF]</td>
<td>Prevent chemical purge if sensor temperature is below 0 °C</td>
</tr>
</tbody>
</table>

### Table 23  Calibration and Adjustment Commands

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRH</td>
<td>Relative humidity calibration</td>
</tr>
<tr>
<td>CT</td>
<td>Temperature calibration</td>
</tr>
<tr>
<td>CTA</td>
<td>Additional temperature probe calibration</td>
</tr>
<tr>
<td>FCRH</td>
<td>Relative humidity calibration after sensor change</td>
</tr>
<tr>
<td>CTEXT</td>
<td>Give the text to calibration information field</td>
</tr>
<tr>
<td>CDATE</td>
<td>Set the calibration date</td>
</tr>
<tr>
<td>ACAL</td>
<td>Analog output calibration</td>
</tr>
<tr>
<td>MPC</td>
<td>Multipoint relative humidity calibration</td>
</tr>
</tbody>
</table>

### Table 24  Setting and Testing the Analog Outputs

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMODE</td>
<td>View the analog output modes</td>
</tr>
<tr>
<td>ASEL</td>
<td>Select the parameters for the analog outputs</td>
</tr>
<tr>
<td>ITEST</td>
<td>Test the analog outputs</td>
</tr>
<tr>
<td>AERR</td>
<td>Change the analog error output values</td>
</tr>
<tr>
<td>AOVER [ON/OFF]</td>
<td>Extend analog output range by 10%</td>
</tr>
</tbody>
</table>

### Table 25  Setting and Testing the Relays

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RSEL</td>
<td>Set and view the relays</td>
</tr>
<tr>
<td>RTEST</td>
<td>Test the relays</td>
</tr>
</tbody>
</table>
Table 26 Other Commands

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>?</td>
<td>Output information about the device</td>
</tr>
<tr>
<td>??</td>
<td>Output information about the device in POLL mode</td>
</tr>
<tr>
<td>ALSEL</td>
<td>Set display alarms</td>
</tr>
<tr>
<td>CON</td>
<td>Set display contrast</td>
</tr>
<tr>
<td>ECHO [ON/OFF]</td>
<td>Turn the serial interface echo ON/OFF</td>
</tr>
<tr>
<td>ERRS</td>
<td>List present transmitter errors</td>
</tr>
<tr>
<td>FILT</td>
<td>Set the result filtering</td>
</tr>
<tr>
<td>FIND</td>
<td>All devices in POLL mode send their addresses</td>
</tr>
<tr>
<td>HELP</td>
<td>List the currently available commands</td>
</tr>
<tr>
<td>LIGHT</td>
<td>Set the display backlight mode</td>
</tr>
<tr>
<td>LOCK</td>
<td>Lock the menu or disable the keypad</td>
</tr>
<tr>
<td>MODBUS</td>
<td>View Modbus diagnostic counters</td>
</tr>
<tr>
<td>MODS</td>
<td>View information about connected modules</td>
</tr>
<tr>
<td>PRES [hPa]</td>
<td>Set the value for pressure compensations</td>
</tr>
<tr>
<td>RHLIMIT [ON/OFF]</td>
<td>Limit highest value of RH output to 100%</td>
</tr>
<tr>
<td>VERS</td>
<td>Display the software version information</td>
</tr>
<tr>
<td>XHEAT</td>
<td>Sensor heating</td>
</tr>
<tr>
<td>XPRES [hPa]</td>
<td>Set the value for pressure compensations, temporarily</td>
</tr>
</tbody>
</table>

Getting Measurement Message from Serial Line

Starting Continuous Outputting

Use the R command to start the continuous output of measurements.

R<cr>

The default output format depends on the quantities your transmitter supports. You can change the output message format and interval with the FORM and INTV commands. See sections FORM on page 101 and INTV on page 115.

Example:

> R
RH= 60.5 %RH T= 23.7 'C Tdf= 15.6 'C Td= 15.6 'C a= 13.0 g/m3  x= 11.1 g/kg  Tw= 18.5 'C H2O= 17889 ppmV pw= 17.81 hPa pws= 29.43 hPa h= 52.3 kJ/kg  dT= 8.1 'C

If a value is too long to fit to the allocated space in the output, or if there is an error in outputting the quantity, the value is displayed with stars ‘*’.

Example:

> R
RH=***.* %RH T= 31.0 'C
Stopping Continuous Outputting

Use the S command to end the RUN mode. After this command all other commands can be used. You can also press the Esc button or reset the transmitter to stop the outputting.

S<cr>

See command SMODE to change the default (power-up) operation mode.

Outputting Reading Once

Use the SEND command to output the reading once in STOP mode.

SEND<cr>

Examples:

>send
RH= 98.4 %RH T= 31.1 °C

>send
RH= 98.4 %RH T= 31.1 °C Td= 36.0 °C Tdf= 36.0 °C a= 42.4 g/m³ x= 38.8 g/kg Tw= 30.8 °C ppm= 62414 pw= 59.53 hPa
pws= 60.52 hPa h= 130.7 kJ/kg

Assign an Alias for the SEND Command

Use the SCOM command to assign a new command that works like the SEND command. The standard SEND command of the transmitter will always function normally whatever the SCOM definition may be. Command names are case-insensitive.

SCOM<cr>

Example (assigning the command MEASURE as an alias for the SEND command):

>scom
Send command : ? measure
>measure
RH= 23.8 %RH T= 21.4 °C
>

You can remove the SCOM definition by pressing Esc when entering the command name:

>scom
Send command : measure ? <esc>
>
Outputting Reading Once From All Transmitters

Use the **DSEND** command to output the reading once from all connected transmitters that are in STOP or POLL modes. In order to avoid data collisions, the transmitters will send their response after a suitable delay. The response includes the transmitters’s address, followed by their measurement message.

**NOTE**

The total execution time of the **DSEND** command depends on the bit rate of the serial port connection. At slow speeds, it will take a considerable amount of time for devices with large address number to respond. The delay will be the same even if there are no other devices at all.

**DSEND**<cr>

Example (transmitters with addresses 3 and 25 responding):

```plaintext
> dsend
  3 RH= 98.4 %RH T= 31.1 'C
  25 RH= 71.1 %RH T= 34.0 'C
>
```

Communicating with a Transmitter in POLL Mode

**OPEN**

When all transmitters on the RS-485 bus are in POLL mode the **OPEN** command sets one transmitter temporarily to STOP mode so that other commands can be entered.

**OPEN** [**aa**]

where

**aa** = Address of the transmitter (0 ... 255)

**CLOSE**

The **CLOSE** command switches the transmitter back to the POLL mode.

Example:

```plaintext
> OPEN 2     (opens the line to transmitter 2, other transmitters stay in POLL mode)
> CRH        (for example, calibration performed)
...          
> CLOSE       (line closed)
```
Formatting Serial Line Message

**NOTE**

Instead of using the **FTIME**, **FDATE** and **FST** commands described in this section, you can use the **FORM** command with modifiers TIME, DATE, and STAT. See section FORM on page 101.

**FTIME and FDATE**

**FTIME** and **FDATE** commands will enable/disable output of time and date to the serial line. To add time to **R** and **SEND** outputs enter:

**FTIME** [x]<cr>

To add date to **R** and **SEND** outputs enter:

**FDATE** [x]<cr>

where

x = ON or OFF

Examples:

```
>send
RH= 98.4 %RH T= 31.0 'C
>ftime on
Form. time     : ON
>send
03:47:59 RH= 98.4 %RH T= 31.0 'C
>fdate on
Form. date     : ON
>send
2004-07-05 03:48:03 RH= 98.4 %RH T= 31.0 'C
>
```
**FST**

To output the state of optional probe heating and chemical purge in connection with **SEND** and **R** commands enter:

```
FST [x]<cr>
```

where

x = ON or OFF (default)

Examples:

```
> fst on
Form. status : ON
```

```
> send
N 0 RH= 40.1 %RH T= 24.0 'C Tdf= 9.7 'C a= 8.7 g/m3 x= 7.5
g/kg Tw= 15.6 'C ppm= 11980 pw= 12.00 hPa pws= 29.91 hPa
h= 43.2 kJ/kg
```

```
> purge
Purge started, press any key to abort.
```

```
> send
S 134 RH= 40.2 %RH T= 24.1 'C Tdf= 9.8 'C a= 8.8 g/m3
x= 7.5
g/kg Tw= 15.7 'C ppm= 12084 pw= 12.10 hPa pws= 30.11 hPa
h= 43.5 kJ/kg
```

where the state of the probe is indicated by the following letters and values:

<table>
<thead>
<tr>
<th>N ... xxx</th>
<th>= Normal operation</th>
<th>where h xxx =</th>
<th>Probe heat power</th>
</tr>
</thead>
<tbody>
<tr>
<td>X ... xxx</td>
<td>= Sensor heating</td>
<td>where xxx =</td>
<td>Sensor temperature (°C)</td>
</tr>
<tr>
<td>H ... xxx</td>
<td>= Chemical purge</td>
<td>where xxx =</td>
<td>Sensor temperature (°C)</td>
</tr>
<tr>
<td>S ... xxx</td>
<td>= Sensor cooling</td>
<td>after purge</td>
<td>where xxx =</td>
</tr>
</tbody>
</table>

For more information on chemical purge, see section Chemical Purge (Optional) on page 133.
General Settings

Changing Quantities and Units

To change quantities and units use serial commands or the optional display/keypad. See Table 3 on page 19 for available quantities and Table 4 on page 19 for optional quantities.

**NOTE**

Only the quantities selected when ordering the device can be selected as display output quantities.

**Using Display/Keypad**

Use display/keypad to select the display output quantities.

1. Press any of the arrow buttons to open the **Main Menu**.
2. Press the ► arrow button to select **Display**.
3. Press ► arrow button to select **Quantities**.
4. Select the quantity by using the ▲▼ arrow buttons. Confirm the selection by pressing **SELECT**. You can select 1 ... 4 display quantities at a time.
5. Press **EXIT** to return to the basic display.

To select display units:

1. Press any of the arrow buttons to open the **Main Menu**.
2. Press the ► arrow button to select **Display**.
3. Use the ▲▼arrow buttons to select **Units**. Confirm the selection by pressing the right-hand arrow button.
4. Use the ▲▼ arrow buttons to select display units. Confirm the selection by pressing **CHANGE**. The unit changes from metric to non-metric or the other way round.
5. Press **EXIT** to return to the basic display.

**NOTE**

Changing the display quantities/units (by using the display/keypad) has no effect on the serial output data.
Using Serial Line

Use the serial line command **FORM** to change the format, and the command **UNIT** to select metric or non-metric output units.

**FORM**

Use the serial line command **FORM** to select the output quantities and format for serial line measurement messages.

**FORM** [x]<cr>

where

x = Formatter string

The formatter string consists of quantities and modifiers. If no formatter string is entered, the command will display the currently active formatter string. Note that the hash symbol “#” is shown as a backslash “\” when viewing the current formatter string.

Example:

```
>form
3.1 "RH=" RH " " U4 3.1 "T=" T " " U3 3.1 "Tdf=" Tdf " " U3
3.1 "Td=" Td " " U3 3.1 "a=" a " " U7 4.1 "x=" x " " U6 3.1
"Tw=" Tw " " U3 6.0 "H2O=" H2O " " U5 4.2 "pw=" pw " " U4
4.2 "pws=" pws " " U4 4.1 "h=" h " " U7 3.1 "dT=" dT " " U3
\r \n
>  
```

When entering the command, use the abbreviations of the quantities. For more information on quantities, see Table 3 and Table 4 on page 19.

The modifiers are presented in Table 27 on page 102.
Table 27  FORM Command Modifiers

<table>
<thead>
<tr>
<th>Modifier</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>x.y</td>
<td>Length modifier (number of digits and decimal places)</td>
</tr>
<tr>
<td>#t</td>
<td>Tabulator</td>
</tr>
<tr>
<td>#r</td>
<td>Carriage-return</td>
</tr>
<tr>
<td>#n</td>
<td>Line feed</td>
</tr>
<tr>
<td>&quot;&quot;</td>
<td>String constant</td>
</tr>
<tr>
<td>#xxx</td>
<td>Special character, code &quot;xxx&quot; (decimal), for example #027 for ESC</td>
</tr>
<tr>
<td>U5</td>
<td>Unit field and length (length optional)</td>
</tr>
<tr>
<td>ADDR</td>
<td>Transmitter address [00...255]</td>
</tr>
<tr>
<td>ERR</td>
<td>Error flags for P, T, Ta, RH [0000 ... 1111], 0 = no error</td>
</tr>
<tr>
<td>STAT</td>
<td>Transmitter status in 7 character field, for example:</td>
</tr>
<tr>
<td></td>
<td>N 0 no heating</td>
</tr>
<tr>
<td></td>
<td>h 115 probe heating active, power 115/255</td>
</tr>
<tr>
<td></td>
<td>H 159.0 purge heating active, temperature 159ºC</td>
</tr>
<tr>
<td></td>
<td>S 115.0 purge cooling active, temperature 115ºC</td>
</tr>
<tr>
<td></td>
<td>X 95.0 sensor heating active, temperature 95ºC</td>
</tr>
<tr>
<td>SN</td>
<td>Transmitter serial number</td>
</tr>
<tr>
<td>TIME</td>
<td>Time [hh:mm:ss]</td>
</tr>
<tr>
<td>DATE</td>
<td>Date [yyyy-mm-dd]</td>
</tr>
<tr>
<td>CS2</td>
<td>Modulus-256 checksum of message sent so far, ASCII encoded hexadecimal notation</td>
</tr>
<tr>
<td>CS4</td>
<td>Modulus-65536 checksum of message sent so far, ASCII encoded hexadecimal notation</td>
</tr>
<tr>
<td>CSX</td>
<td>NMEA xor-checksum of message sent so far, ASCII encoded hexadecimal notation</td>
</tr>
</tbody>
</table>

Examples:

```plaintext
>form "RH=" 4.2 rh U5 #t "T=" t U3 #r #n
OK
>send
RH= 16.03%RH T= 74.66'F

>form "Tfrost=" tdf U3 #t "Temp=" t U3 #r#n
OK
>send
Tfrost= 36.0'C Temp= 31.0'C
```

Command `FORM /` will return the default output format. The default output format depends on the device configuration.

```plaintext
>form /
OK
>send
RH= 98.4 %RH T= 31.1 'C
```
UNIT

Use the UNIT command to select metric or non-metric output units, and change the unit for the H2O quantity:

UNIT [x]<cr>

where

x  =  Unit system to be used. Options are:
    M (metric units)
    N (non-metric units)

UNIT H2O [y]<cr>

where

y  =  Unit to be used for H2O. Options are:
    PPMV (parts per million by volume)
    PPMW (parts per million by weight)

NOTE

This command changes both the serial output and display units. When you want to output both metric and non-metric units simultaneously on the display, select the display units later by using the display/keypad.

Examples:

>unit m
Output units  : metric
>
>unit h2o ppmv
H2O units    : ppmV
>
Pressure Compensation Setting

The pressure has an effect on humidity calculations and accuracy. Therefore, accurate calculations can be achieved only when the process pressure is taken into consideration.

Note that conversions from mmHg and inHg are defined at 0°C and for mmH₂O and inH₂O at 4°C.

**NOTE**

Pressure compensation is intended to be used in normal air only. When measuring in other gases, please contact Vaisala for further information.

Using Display/Keypad

Use display/keypad to set the pressure compensation. To select the pressure unit using display/keypad, see section Changing Quantities and Units on page 100.

1. Press any of the arrow buttons to open the **Main Menu**.
2. Select **Measuring** and press the ►arrow button to confirm your selection.
3. Select Pressure compensation and press the ►arrow button to confirm your selection.
4. Press **SET** and enter the pressure value in the chosen unit by using the arrow buttons.
5. Press **OK** and **EXIT** to return to the basic display.

Using Serial Line

PRES and XPRES

Command **XPRES** must be used if the value is changed frequently (for example, by an automatic system that updates the value). Its value is not retained at reset, and when set to 0; last value set with **PRES** is used instead. Use the serial line and do the following:

**PRES** [aaaa.a]<cr>

**XPRES** [aaaa.a]<cr>

where

aaaa.a = Absolute process pressure (hPa)

Example:

```plaintext
>pres
Pressure : 1013.00 hPa ?
>pres 2000
Pressure : 2000.00 hPa
>
```
Table 28  Conversion Factors for Pressure Units

<table>
<thead>
<tr>
<th>From</th>
<th>To: hPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>mbar</td>
<td>1</td>
</tr>
<tr>
<td>Pa N/m²</td>
<td>0.01</td>
</tr>
<tr>
<td>mmHg torr</td>
<td>1.33224</td>
</tr>
<tr>
<td>inHg</td>
<td>33.86388</td>
</tr>
<tr>
<td>mmH₂O</td>
<td>0.0980665</td>
</tr>
<tr>
<td>inH₂O</td>
<td>2.490889</td>
</tr>
<tr>
<td>atm</td>
<td>1013.25</td>
</tr>
<tr>
<td>at</td>
<td>980.665</td>
</tr>
<tr>
<td>bar</td>
<td>1000</td>
</tr>
<tr>
<td>psia 1)</td>
<td>68.94757</td>
</tr>
</tbody>
</table>

1) psia = psi absolute.

For example, 29.9213 inHg = 29.9213 × 33.86388 = 1013.25 hPa.

**Limit RH Output Range**

Use the serial line command `RHLIMIT` if you want to strictly limit the allowed value of the relative humidity (RH) quantity to range 0 ... 100%. The limit is implemented on all outputs and the display. Other quantities are not affected, only RH. Note that seeing values above 100 %RH is useful for detecting condensation on the sensor, and possible measurement drift in very high humidities. For this reason, Vaisala recommends leaving this feature at the default setting (off).

`RHLIMIT [ON/OFF]<cr>`

where

ON = Allowed range of RH output is 0 ... 100 %.
OFF = Allowed range of RH output is -5 ... 110 % (default).

Example (view current setting):

```
> rhlimit ?
RH limit 0...100: OFF
```

Example (enable RH limit):

```
> rhlimit on
RH limit 0...100: ON
```
Date and Time

Using Display/Keypad

If the optional Data Logger Module is installed, you can change the time and date using the display/keypad.

1. Press any of the arrow buttons to open the Main Menu.
2. Select System and press the ► arrow button to confirm your selection.
3. Select Date and time and press the ► arrow button.
4. Press the SET button to enter the adjustment mode, and use the arrow buttons to select and change the values.
5. You can also change the date and time formats that are shown in the graphs. The selected formats are only used in graphical display, they do not change the formats that are used in the serial communication.
6. Press EXIT to return to the basic display.

Using Serial Line

To set time enter the TIME command. To set date enter the DATE command.

TIME<cr>
DATE<cr>

These time and date settings are shown on the timestamps of PLAY command. When you want to include time and date in the R and SEND commands, use the FTIME and FDATE commands.

Example:

>time
Time : 13:42:49 ?

>date
Date : 2007-05-31 ?

NOTE

If the optional Data Logger Module is not installed, time and date available on the serial ports (only) are cleared to 2000-01-01 00:00:00 at reset or at power failure.
Data Filtering

The averaging data filter calculates an average over a certain period of time. The lowest measurement noise is achieved with the extended filtering. There are three filtering levels available.

Table 29 Filtering Levels

<table>
<thead>
<tr>
<th>Setting</th>
<th>Filtering Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>No filtering (default setting).</td>
</tr>
<tr>
<td>STANDARD</td>
<td>Standard filtering. Approximately 13 s moving average.</td>
</tr>
<tr>
<td>EXTENDED</td>
<td>Extended filtering. Approximately 1 min average by default, but configurable on the serial line.</td>
</tr>
</tbody>
</table>

Using Display/Keypad

1. Press any of the arrow buttons to open the Main Menu.
2. Select Measuring by pressing the ► arrow button.
3. Select Filtering and press CHANGE to confirm your selection.
5. Press EXIT to return to the basic display.

Using Serial Line

Use the serial line command FILT to set the filtering level.

FILT [level] [extfactor]<cr>

where

level = Filtering level. The options are:

- OFF (no filtering, default setting)
- ON (standard filtering, approximately 13 s moving average)
- EXT (extended filtering, approximately 1 min average by default but configurable by changing the extfactor)

extfactor = Weighted average factor for extended filtering level. Range 0 ... 1, default 0.030.

In extended filtering mode, the output is calculated based on the following formula:

\[ \text{(new result} \times \text{extfactor}) + (\text{old result} \times (1.0 - \text{extfactor})) \]

This means that with extfactor value 1 the transmitter will take only the latest measurement into account, but with extfactor value 0.1 a new output is a combination of the previous output (90%) and the latest measurement (10%).
Example (enable standard filtering):

```plaintext
>filt on
Filter              : ON
>
```

**Device Information**

Use the display/keypad or the serial line to display the device information.

Press the **INFO** button in the basic display to see the following information:

- Current sensor operation (for example, chemical purge), if any, in progress
- Present or past unacknowledged errors, if any
- Device information
- Current date and time (only shown if data logger module installed)
- Adjustment information fed by the user
- Measuring settings
- Information on chemical purge settings (when applicable)
- Display Alarm settings
- Serial interface information
- Network settings and status of the LAN and WLAN interfaces
- Analog output information
- Relay output information (when applicable)

![Serial Interface Information](image)

**Figure 61 Device Information on Display**

Proceed in the information views by pressing the **MORE** button repeatedly until you get the desired information. You can browse through the information displays also with arrow buttons. Press **OK** to return to the basic display.
Use the serial line command `?` to check the current transmitter configuration. Command `??` is similar but can also be used if the transmitter is in POLL mode.

Example:

```
>?
HMT330 / 5.10.0
Serial number   : D1140055
Batch number    : D0750008
Adjust. date    : 2010-12-17
Adjust. info    : Helsinki / FIN
Date            : 2011-02-09
Time            : 09:29:35
Serial mode     : STOP
Baud P D S      : 19200 N 8 1
Output interval : 10 s
Address         : 0
Echo            : ON
Pressure        : 1013.25 hPa
Filter          : OFF
Module 1        : LOGGER-1       (1024 MB; HW: B; SW: 3)
Module 2        : not installed
```

**LIGHT**

Use the **LIGHT** command to view or set the backlight mode of the display (optional). Issuing the command without specifying a mode shows the current backlight mode.

**LIGHT [mode]<cr>**

where

- **mode** = Operating mode of the display backlight. The options are:
  
  - ON (backlight always on)
  - OFF (backlight always off)
  - AUTO (backlight automatically turns on and off when keypad is used)

Example:

```
>light
Backlight      : OFF
>light auto
Backlight      : AUTO
>``
HELP

Use the HELP command to list the currently available commands. The available commands are determined by the device configuration and installed options.

Example:

```
> help

?       ACAL       ADDR       AERR       ALSEL
ASEL     CDATE      CLOSE      CON       CRH
CT       CTEXT      DATE       DELETE     DR
DSEL     DSEND      ECHO       ERRS       FCRH
FILT     FORM       HELP       INTV       ITEST
LIGHT    LOCK       MODBUS     MODS       PLAY
PRES     R          RESET      SCOM       SDELAY
SEND     SRI        SMODE      SYSTEM     TEST
TIME     UNDELETE   UNIT       VER       XPRES
>
```

ERRS

Use the ERRS command to display transmitter error messages, see Table 33 on page 152.

Example (no active errors):

```
> errs
No errors
```

Example (showing active error):

```
> errs
Error: E2  Humidity sensor open circuit.
```

MODS

Use the MODS command to display information about the optional modules that are connected to the transmitter.

Example:

```
> mods
Module 2       : LOGGER-1       (1024 MB; HW: B; SW: 5)
```
VERS

Use the VERS command to display software version information.

Example:

> vers
HMT330 / 5.10
>

Resetting Transmitter Using Serial Line

RESET

This command resets the device. The user port switches to start-up output mode selected with command SMODE.

Locking Menu/Keypad Using Serial Line

LOCK

Use the LOCK command to prevent the user from entering the menu using the keypad, or to lock the keypad completely. You can optionally set a 4-digit PIN code, for example 4444.

If a PIN code has been set, the user will be prompted to enter the code when trying to access the menu. Entering the code correctly will disable the lock until the user returns back to the basic view.

LOCK [x] [yyyy]<cr>

where

x = Keypad locking level, range 0...2. The options are:
   0 - No lock (enables full access)
   1 - Menu locked, but graphs are accessible
   2 - Keypad completely disabled

yyyy = 4-digit PIN code. The code can only be set when keypad locking level is 1.

Examples:

> lock 1 4444
Keyboard lock : 1 [4444]
>
> lock 1
Keyboard lock : 1
>
Serial Output Settings

The communication settings for the user port can be changed via the serial line or by using the optional display/keypad. The communication settings for the service port are fixed and not changeable.

**NOTE**

If a communication module (LAN, WLAN, or RS-422/485 interface) has been installed, the user port is not accessible. Any changes to the settings are applied to the interface provided by the module, if applicable.

Using Display/Keypad

1. Press any of the arrow buttons to open the **Main Menu**.
2. Select **Interfaces** and press the ► arrow button to confirm your selection.
3. Select **Serial interface** and press the ► arrow button to confirm your selection.
4. Select **Bit rate** and **Serial format** by pressing the **CHANGE** button. Use the ▲▼ arrow buttons to select and press **SELECT** to confirm your selection.
5. Select the **Protocol** to be used by the serial output by pressing the **CHANGE** button. Select the option using the ▲▼ arrow buttons and press **SELECT**. This is the same serial mode setting that is changed by the **SMODE** serial command.
   - **RUN** mode continuously outputs the measurement message at the set interval. If you select the RUN mode, set the desired **RUN interval** also.
   - **POLL** mode enables multiple transmitters to share the same RS-485 line. If you select the POLL mode, select the **Device address** also, as each transmitter on the line must have a unique address.
   - In **STOP** mode, transmitter outputs the transmitter software version at reset or power-up and remains silent, waiting for commands.
   - The **SEND** mode is almost identical to the STOP mode. The only difference is that the transmitter outputs a measurement message at start-up, instead of software version.
   - In **MODBUS** mode, only Modbus protocol communication is available. See Chapter 5, Modbus, on page 141.
6. Select the **RUN interval** and the unit. Press **OK** to confirm.
7. Select the **Device address** and press **SET** to confirm.
8. Select **ECHO**, and press **ON** to turn to it on, **OFF** to turn it off.
9. Press **EXIT** to return to the basic display. The new user port settings set using the display/keypad are effective immediately.
Using Serial Line

NOTE
You can use the serial commands to change/view the user port settings even if you are currently connected to the service port.

SERI

Use the SERI command to set the communication settings for the user port. Changed settings will be activated at next reset or power up.

SERI \[b\ p\ d\ s]\<cr>

where

\[b\] = Bit rate (110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200)

\[p\] = Parity (n = none, e = even, o = odd)

\[d\] = Data bits (7 or 8)

\[s\] = Stop bits (1 or 2)

The settings can be changed one parameter at a time or all parameters at once.

Example (changing all parameters):

\[SERI 600 N 8 1\]

\[600\ N\ 8\ 1\]

\[>>\]

Example (changing parity only):

\[SERI O\]

\[4800\ O\ 7\ 1\]
SMODE

Use the **SMODE** command to set the user port start-up operating mode.

**SMODE [xxxx]<cr>**

where

**xxx =** STOP, SEND, RUN, POLL, or MODBUS.

**Table 30 Selection of Output Modes**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Measurement Output</th>
<th>Available Commands</th>
</tr>
</thead>
<tbody>
<tr>
<td>STOP</td>
<td>Only with the SEND command.</td>
<td>All (default mode).</td>
</tr>
<tr>
<td>SEND</td>
<td>One measurement message automatically at start-up, then only with the SEND command.</td>
<td>All.</td>
</tr>
<tr>
<td>RUN</td>
<td>Automatic output.</td>
<td>Only command S.</td>
</tr>
<tr>
<td>POLL</td>
<td>Only with the SEND [addr] command.</td>
<td>SEND [addr] and OPEN [addr]. Other commands available after opening a line to the transmitter using the OPEN command. Use with RS-485 buses where multiple transmitters can share the same line.</td>
</tr>
<tr>
<td>MODBUS</td>
<td>Must be read from the transmitter using Modbus protocol.</td>
<td>Modbus protocol only; see Chapter 5, Modbus, on page 141.</td>
</tr>
</tbody>
</table>

Selected output mode will be activated at next reset or power up.

**ADDR**

Use the **ADDR** command to set the device address of the transmitter. Addresses are required for POLL mode and MODBUS mode (serial Modbus).

**ADDR [aa]<cr>**

where

**aa =** Device address of the transmitter, range 0 ... 255 (default = 0)

Example (changing the transmitter address from 0 to 52):  

```
>addr
Address : 0 ? 52
>
```
INTV

Use the INTV command to set the RUN mode output interval. The time interval is used only when the RUN mode is active. Setting the interval to zero enables the fastest possible output rate.

\textbf{INTV} [xxx yyy]<cr>

where

\begin{align*}
xxx &= \text{Delay, range } 0 \ldots 255. \\
yyy &= \text{Unit: S, MIN or H.}
\end{align*}

Example (setting the output interval to 10 minutes):

\begin{verbatim}
>intv 10 min
Output interval: 10 min
>
\end{verbatim}

SDELAY

With the SDELAY command you can set delay (response time) for user port, or view currently set delay value. Adjusting the delay may be needed when half-duplex communication (typically two-wire RS-485) is used.

The delay value corresponds to tens of milliseconds (for example, 5 = 0.050s minimum answer delay). The value can be set between 0 \ldots 254.

Example:

\begin{verbatim}
>sdelay
Serial delay   : 0 ? 10

>sdelay
Serial delay   : 10 ?
\end{verbatim}

ECHO

Use the ECHO command to set the user port echo. The command either enables or disables echo of characters received.

\textbf{ECHO} [x]<cr>

where

\begin{align*}
x &= \text{ON (enabled, default) or OFF (disabled)}
\end{align*}

\textbf{NOTE}

When using the RS-485 interface with a 2-wire connection, always disable echo. When using a RS-232, RS-422/485 4-wire connection, LAN, or WLAN, you can enable or disable it as you wish.
Data Recording

Data recording function is always on and collects data automatically into the memory of the device. If the optional data logger module is installed, the transmitter uses it automatically. Recorded data does not disappear from the memory when the power is switched off. Collected data can be observed in a form of a graph in the graphical view of the display or it can be listed out by using the serial line or MI70 Link program.

Selecting Data Recording Quantities

If the device is provided with the optional display, the recorded quantities are always those selected for the display. Up to four quantities can be recorded at a time. For instructions on how to select the display quantities with the keypad, see section Changing Quantities and Units on page 100.

DSEL

Use the serial line command DSEL to select the quantities to be recorded if the transmitter is not equipped with display/keypad.

DSEL \[xxx]\[cr>

where

xxx = Data recording quantity. See Table 3 on page 19 and Table 4 on page 19 for the quantities.

Example:

>dsel rh t tdf
RH T Tdf
>

Enter the command without parameters and press ENTER to display the current recording parameters.

View Recorded Data

If the device is provided with the optional display, the graphical display shows the data of the selected quantities, one at a time. See section Graphic History on page 68 for details about graphical display.

You may also dump the logged data to the serial line in numeric form with the following commands.

DIR

Use the serial line and enter the DIR command to check the available files.

Without the data logger module, the device records six files (six observation periods) for each selected quantity. The data logger raises the
number of recorded files to seven for each quantity. Thus, the total amount of the files varies between 6 and 28. See Table 11 on page 68.

Select, for example, three quantities (RH, T, and Tdf). The last column illustrates the number of data points that has been stored in the file.

Example (data logger module installed):

```
> dir
File description          Oldest data available  No. of points
1  RH   (10 s intervals)  2007-05-30 08:26:50  13996800
2  RH   (90 s intervals)  2007-05-30 05:25:30  1555200
3  RH   (12 min intervals) 2007-05-29 05:48:00  194400
4  RH   (2 h intervals)   2007-05-19 02:00:00  194400
5  RH   (12 h intervals)   2007-03-23 12:00:00  3240
6  RH   (3 d intervals)    2006-04-20 00:00:00  540
7  RH   (12 d intervals)   2002-12-16 00:00:00  135
8  T    (10 s intervals)  2007-05-30 08:26:50  13996800
9  T    (90 s intervals)  2007-05-30 05:25:30  1555200
10 T   (12 min intervals) 2007-05-29 05:48:00  194400
11 T   (2 h intervals)    2007-05-19 02:00:00  194400
12 T   (12 h intervals)   2007-03-23 12:00:00  3240
13 T   (3 d intervals)    2006-04-20 00:00:00  540
14 T   (12 d intervals)   2002-12-16 00:00:00  135
15 Tdf (10 s intervals)  2007-05-30 08:26:50  13996800
16 Tdf (90 s intervals)  2007-05-30 05:25:30  1555200
17 Tdf (12 min intervals) 2007-05-29 05:48:00  194400
18 Tdf (2 h intervals)   2007-05-19 02:00:00  194400
19 Tdf (12 h intervals)   2007-03-23 12:00:00  3240
20 Tdf (3 d intervals)    2006-04-20 00:00:00  540
21 Tdf (12 d intervals)   2002-12-16 00:00:00  135
```

Example (without data logger module):

```
> dir
File description          Oldest data available  No. of points
1  RH   (10 s intervals)  2008-04-11 23:41:10  135
2  RH   (90 s intervals)  2008-04-11 20:41:11  135
3  RH   (12 min intervals) 2008-04-10 21:03:41  135
4  RH   (2 h intervals)   2008-03-31 18:03:41  135
5  RH   (12 h intervals)   2008-02-04 12:03:41  135
6  RH   (3 d intervals)    2008-04-11 23:41:11  135
7  RH   (12 d intervals)   2008-04-10 21:03:41  135
8  T    (10 s intervals)  2008-04-11 23:41:11  135
9  T    (90 s intervals)  2008-04-11 20:41:11  135
10 T   (12 min intervals) 2008-04-10 21:03:41  135
11 T   (2 h intervals)    2008-03-31 18:03:41  135
12 T   (12 h intervals)   2008-02-04 12:03:41  135
14 T   (12 d intervals)   2008-04-10 21:03:41  135
15 Tdf (10 s intervals)   2008-04-11 23:41:11  135
16 Tdf (90 s intervals)   2008-04-11 20:41:11  135
17 Tdf (12 min intervals) 2008-04-10 21:03:41  135
18 Tdf (2 h intervals)    2008-03-31 18:03:41  135
19 Tdf (12 h intervals)   2008-02-04 12:03:41  135
20 Tdf (3 d intervals)    2008-04-11 23:41:11  135
21 Tdf (12 d intervals)   2008-04-10 21:03:41  135
```
**PLAY**

Use the PLAY command to output the selected file to the serial line. If the data logger module is installed, you can specify an interval to be outputted.

Data in the output is <TAB> delimited. This is compatible with most spreadsheet programs. Before giving the command, set the local date and time with TIME and DATE commands, if needed.

**PLAY [x] [start_date start_time end_date end_time]<cr>**

where

\[ x = \text{Number of the data file that will be outputted, range 0...21.} \]
\[ \text{The numbers correspond to the output of the DIR command; refer to the example on page 116.} \]
\[ \text{Selecting number 0 will output all data files.} \]
\[ \text{start_date} = \text{Starting date of the interval to be outputted. Must be given in the following format: yyyy-mm-dd.} \]
\[ \text{start_time} = \text{Starting time of the interval to be outputted. Must be given in the format hh:mm:ss or h:mm.} \]
\[ \text{end_date} = \text{Ending date of the interval to be outputted. Must be given in the following format: yyyy-mm-dd.} \]
\[ \text{end_time} = \text{Ending time of the interval to be outputted. Must be given in the format hh:mm:ss or h:mm.} \]

Example:

```
>play 3 2007-05-05 00:00:00 2007-05-06 00:00:00
RH   (12 min intervals) 2007-05-05 00:00:00 121
Date     Time       trend   min     max
yyyy-mm-dd  hh:mm:ss   %RH     %RH     %RH
2007-05-05  00:00:00 19.16   18.99   19.33
2007-05-05  00:12:00 19.30   19.09   19.55
2007-05-05  00:24:00 20.01   19.28   21.17
2007-05-05  00:36:00 21.21   20.98   21.44
2007-05-05  00:48:00 19.57   17.72   21.11
2007-05-05  01:00:00 19.09   18.62   19.84
...```

You can use the <ESC> key to interrupt the output listing.

**NOTE**

Output of large amounts of recorded data can result in huge data files and take a long time, up to several days for the entire memory of the data logger at 10 second resolution. To make it easier to process the data it is recommended to select the largest suitable data interval, and to specify the start and end times carefully.
Deleting the Recorded Files

You can delete the recorded data files using the keypad/display, or the DELETE command on the serial line. The deletion is always done for all data; you cannot delete individual files.

Note that the transmitter automatically overwrites the old data when the memory is full, so manual deletion of the recorded files is not necessary in normal use.

To delete the data files using the keypad/display:

1. Press any of the arrow buttons to open the Main Menu.
2. Select System by pressing the ► arrow button.
3. Select Clear graph memories by pressing the CLEAR button. Press the YES button to confirm the selection.

CAUTION

This function clears the entire data history of the transmitter, including all graphs and the content of the optional data logger module.

UNDELETE

Similarly to the DELETE command, the UNDELETE command is used without any arguments. It will recover all deleted data that has not been overwritten yet.
Analog Output Settings

The analog outputs are set in the factory according to the order form. In case you want to change the settings, follow these instructions. See section Third Analog Output on page 54.

Changing Output Mode and Range

Both output channels have their own DIP switch module with 8 switches; see the position in Figure 2 on page 22 (DIP switches for analog output settings).

1. Select the current/voltage output; switch ON either of the switches, 1 or 2.
2. Select the range; switch ON one of the switches from 3 to 7.

Figure 62  Current/Voltage Switches of Output Modules

The following numbers refer to Figure 62 above:

1 = Current/voltage selection output switches (from 1 to 2)
2 = Current/voltage range selection switches (from 3 to 7) in analog output 1 and 2.
3 = Switches for service use only. Keep in OFF position always.

NOTE

Only set one mode and one range switch to ON for one output channel. The rest of the switches must remain OFF.
Example: 0 ... 5 V voltage output selected for channel 1 and 4 ... 20 mA selected for channel 2.

<table>
<thead>
<tr>
<th>OFF</th>
<th>ON</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

**Selection**

<table>
<thead>
<tr>
<th>Voltage output selected</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>0 ... 5 V selected</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Current output selected</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>4 ... 20 mA selected</th>
</tr>
</thead>
</table>

**NOTE**

If you have customized the error output setting (AERR), check that the set error values are still valid after changing the output mode/range. See section Analog Output Fault Indication Setting on page 124.

**Analog Output Quantities**

Use the display/keypad to change and scale the analog output quantities.

1. Press any of the arrow buttons to open the **Main Menu**.
2. Select **Interfaces** by pressing the ► arrow button.
3. Select **Analog outputs** by pressing the ► arrow button.
4. Select **Output 1/2/3** by pressing the ► arrow button.
5. Select **Quantity** by pressing the ▲▼ arrow buttons. Confirm your selection by pressing **CHANGE**.
6. Select the quantity by using the arrow buttons. Press **SELECT** to confirm your selection.
7. Select **Scale**, lower limit, by pressing the ▲▼ arrow buttons. Press **SET** to confirm your selection. Press **OK** to confirm your setting.
8. Select the upper limit by pressing the ▲▼ arrow buttons. Use the arrow buttons to set the upper limit value. Press **SET** to confirm your selection. Press **OK** to confirm your setting.
9. Press **EXIT** to return to the basic display.
AMODE/ASEL

Use the serial line to select and scale the analog output quantities. Check the analog output modes with the **AMODE** command.

**AMODE<cr>**

Example:

> amode
Ch1 output : 0...1V
Ch2 output : 0...1V
>

Select and scale the quantities for the analog outputs with the command **ASEL**. Note that the optional quantities can be selected only if they have been selected when ordering the device.

**ASEL [xxx yyy zzz]<cr>**

where

<table>
<thead>
<tr>
<th>xxx</th>
<th>Quantity of channel 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>yyy</td>
<td>Quantity of channel 2</td>
</tr>
<tr>
<td>zzz</td>
<td>Quantity of the optional analog output channel 3</td>
</tr>
</tbody>
</table>

Always enter the quantities for all outputs. For quantities and their abbreviations see Table 3 on page 19 and Table 4 on page 19.

Use the **ASEL [xxx yyy]** command as shown in the example below when using a device with two analog outputs.

Example:

> asep rh t
Ch1 (RH ) low : 0.00 %RH ? 0
Ch1 (RH ) high : 100.00 %RH ? 100
Ch2 (T ) low : -40.00 'C ? -50
Ch2 (T ) high : 60.00 'C ? 80
>
Analog Output Tests

Use the display/keypad to test the operation of the analog output{s} by forcing the outputs to known values. Measure then the outputs with a current/voltage meter.

1. Press any of the arrow buttons to open the Main Menu.
2. Select System by pressing the ► arrow button.
3. Select Diagnostics by pressing the ► arrow button.
4. Select Analog output tests by pressing the ► arrow button.
5. Select one of the testing options Force 0%/50%/100% of scale. Press TEST to confirm your selection. All outputs are tested simultaneously. The actual output value depends on the selected range.
6. Press OK to stop testing. Press EXIT to return to the basic display.

ITEST

Use the ITEST command to test the operation of the analog outputs. The ITEST command forces the analog outputs to entered values. The analog outputs remain at these values until you enter the command ITEST without parameters or reset the transmitter.

ITEST [aa.aaa bb.bbb cc.ccc]<cr>

where

\[
\begin{align*}
\text{aa.aaa} & = \text{Current or voltage value to be set for channel 1 (mA or V)} \\
\text{bb.bbb} & = \text{Current or voltage value to be set for channel 2 (mA or V)} \\
\text{cc.ccc} & = \text{Current or voltage value to be set for channel 3 (optional) (mA or V)}
\end{align*}
\]

Examples:

```
>itest 20 5
Ch1 (Td ) : *         20.000 mA H'672A
Ch2 (T ) : *         5.000 mA H'34F9

>itest
Ch1 (Td ) : -23.204 'C  16.238 mA H'FFFE
Ch2 (T ) :  22.889 'C  8.573 mA H'5950
>```

Analog Output Fault Indication Setting

Factory default state for analog outputs during error condition is 0 V/ 0 mA. Please be careful when selecting the new error value. The error state of the transmitter should not cause unexpected problems in process monitoring.

Use the display/keypad to set the analog output fault indication.

1. Press any of the arrow buttons to open the **Main Menu**.
2. Select **Interfaces** by pressing the ► arrow button.
3. Select **Analog Outputs** by pressing the ► arrow button.
4. Select **Output 1/2/3** by pressing the ► arrow button.
5. Select Fault indication. Press **SET** to confirm your selection. Enter the fault indication value by using the arrow buttons. Press **OK** to confirm your setting. This value is outputted if a transmitter error occurs.
6. Press **EXIT** to return to the basic display.

**AERR**

Use the serial line **AERR** command to change the error output.

Example:

```
>aerr
Ch1 error out : 0.000V ? 5.0
Ch2 error out : 0.000V ? 5.0
>
```

**NOTE**
The error output value must be within a valid range of the output mode.

**NOTE**
The error output value is displayed only when there are minor electrical faults such as humidity sensor damage. When there is a severe device malfunction, the error output value is not necessarily outputted.
Extend Analog Output Range

Use the \texttt{AOVER} command to allow the analog output channels to exceed their specified range by 10\%. The scaling of the parameter remains as before; the extra range is used for additional measurement range in the high end of the scale.

\texttt{AOVER [ON/OFF]\langle cr\rangle}

Example:

\texttt{>aover on}
\texttt{Extended output: ON}
\texttt{>}

The following example illustrates how the analog output is affected. Channel 1 outputs RH with voltage output 0 \ldots 5 \text{ V} (0 \ldots 100 \text{ %RH}). After giving the \texttt{AOVER ON} command, the range is 0 \ldots 5.5 \text{ V} (0 \ldots 110 \text{ %RH}). Note that the 100 \text{ %RH} point is still at 5 \text{ V}.

Operation of Relays

Quantity for Relay Output

A relay monitors the quantity chosen for the relay output. Any of the quantities available can be chosen.

Measurement-Based Relay Output Modes

Relay Setpoints

When the measured value is in between the "above" and "below" values, the relay is passive. When choosing lower value as "above" value and higher value as "below" value, the relay is passive when the measured value is not between the setpoints. You can also set only one setpoint. See Figure 63 on page 126 for illustrative examples of the different measurement-based relay output modes.
Figure 63 Measurement-Based Relay Output Modes

Mode 4 is usually used if an alarm needs to be triggered when the measured value exceeds a safe range. The relay is active when measurement is in range, and is released if the value goes out of range or the measurement fails.

NOTE If the measurement of the selected quantity fails or the transmitter loses its power, the relay is released.
**Hysteresis**

Hysteresis function is to prevent the relay switching back and forth when the measured value is near to the setpoint values.

Relay is activated when the measured value passes the exact value of the setpoint. When returning and passing the setpoint again relay is not released before the value reaches the setpoint increased/decreased by the hysteresis value.

Hysteresis should be smaller than difference of the setpoints.

Example: When the 'active above' value is 60 %RH and the hysteresis value is 5 %RH, relay activates when the relative humidity reaches 60 %RH. As the humidity decreases, relay releases at 55 %RH.

**NOTE**

If both setpoints are specified and "above" setpoint is lower than "below" setpoint, the hysteresis works in the opposite direction, that is, relay is released when the measured value passes the exact value of the setpoint.

**Relay Indicating Transmitter Error Status**

You can set a relay to follow the operation status of the device. By selecting FAULT/ONLINE STATUS for output quantity a relay changes state on the basis of the operation status as follows:

**FAULT STATUS**

Normal operation: relay active (C and NO outputs are closed)

Not measuring state (error state or power off): relay released (C and NC outputs are closed)

**ONLINE STATUS**

Live measurement (data available): relay active (C and NO outputs are closed)

No live data (for example: error state, chemical purge or adjustment mode): relay released (C and NC outputs are closed)

See Figure 64 on page 128 for illustrative examples of the FAULT/ONLINE STATUS relay output modes.
Analog output vs. "FAULT STATUS" relay

Fault/Online Status relay modes:

- Relay is released in case of a measurement failure only.

Analog output vs. "ONLINE STATUS" relay

Legend:

- AERR: Analog output "fault indication" value set by user
- Outputs frozen because of e.g. purge
- Measurement failure because of e.g. damaged sensor
- True value of the measurement parameter during the exceptional situation
- Relay active (NO – C connected)
- ● Relay is activated
- ○ Relay is released

Figure 64   FAULT/ONLINE STATUS Relay Output Modes

Fault/Online Status relays are usually used in conjunction with an analog output to obtain validity information for the output value.

NOTE

If transmitter loses its power, all status-based relays are released similarly to the case of an instrument failure.
Table 31 Relay State Examples

<table>
<thead>
<tr>
<th>Criterion for Relay Activation</th>
<th>Transmitter Operation Status</th>
<th>NC-C Connected</th>
<th>NO-C Connected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not chosen</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Power off</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RH below 50 %*</td>
<td>Measured RH above 50 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Measured RH below 50 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RH above 50 %*</td>
<td>Measured RH above 50 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Measured RH below 50 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fault status</td>
<td>Measurement OK</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Error active</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Online status</td>
<td>Measurement live</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Purge or sensor heating active</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Hysteresis has an effect when relay switching is based on live measurement. See section Hysteresis on page 127.

Enabling/Disabling Relays

You can deactivate the relay outputs for example for service purposes of your system.

Setting Relay Outputs

NOTE

When you have only one relay module installed, its relays are called “relay 1” and “relay 2”.

When you have two relay modules, the relays of the module connected to slot MODULE 1 are called “relay 1” and “relay 2” and relays connected to slot MODULE 2 are called “relay 3” and “relay 4”.

VAISALA
Figure 65  Relay Indicators on Display

The following number refers to Figure 65 above:

1  =  Lists enabled relays. Activation state shown in black. Disabled relays are not shown.

Use the display/keypad to set the relay outputs.
1. Press any of the arrow buttons to open the Main Menu.
2. Select Interfaces, confirm by pressing the ► arrow button.
3. Select Relay outputs, confirm by pressing the ► arrow button.
4. Select Relay 1/2/3/4, confirm by pressing the ► arrow button.
5. Select the Quantity, confirm by pressing Change. Select the Quantity by using the arrow buttons. Confirm your selection by pressing Select.
6. Select Act. above / Act. below. Press SET to confirm your selection. (If asked, select MODIFY if you want to set the setpoint by using the arrow buttons. Select REMOVE if you want to remove the setpoint.)
7. Select Hysteresis by using the arrow buttons. Press SET to set the hysteresis. Press OK.
8. Select Relay enable by using the arrow buttons, press ON/OFF to enable/disable the relay.

RSEL

Use the serial line to select the quantity, setpoints and hysteresis or enable/disable the relay outputs. Enter the RSEL command.

RSEL [q1 q2 q3 q4]<cr>

where

\( q1 \) = Quantity for the relay 1 or Fault/Online
\( q2 \) = Quantity for the relay 2 or Fault/Online
\( q3 \) = Quantity for the relay 3 or Fault/Online
\( q4 \) = Quantity for the relay 4 or Fault/Online

Factory setting: All relays disabled.
Use the quantity abbreviations presented above. See Table 3 on page 19 and Table 4 on page 19.

Example of window limit switch: Selecting relay 1 to follow relative humidity measurement and relay 2 to follow temperature measurement. Two relay setpoints are set for both relays.

```plaintext>
> rsel rh t
Rel1 RH above: 0.00 %RH ? 30
Rel1 RH below: 0.00 %RH ? 40
Rel1 RH hyst : 0.00 %RH ? 2
Rel1 RH enabl: OFF ? ON
Rel2 T above: 0.00 'C ? 30
Rel2 T below: 0.00 'C ? 40
Rel2 T hyst : 0.00 'C ? 3
Rel2 T enabl: OFF ? ON
>
```

Example of normal limit switch: Selecting relay 1 to follow relative humidity, relay 2 to follow temperature, relay 3 to follow dewpoint and relay 4 to follow dewpoint. One setpoint is chosen for all the outputs.

```plaintext>
> rsel rh t td td
Rel1 RH above: 60.00 %RH ? 70
Rel1 RH below: 70.00 %RH ? -
Rel1 RH hyst : 2.00 %RH ? 2
Rel1 RH enabl: ON ? on
Rel2 T above: 50.00 'C ? 60
Rel2 T below: 40.00 'C ? -
Rel2 T hyst : 2.00 'C ? 2
Rel2 T enabl: ON ? on
Rel3 Td above: 5.00 'C ? 10
Rel3 Td below: 0.00 'C ? -
Rel3 Td hyst : 1.00 'C ? 1
Rel3 Td enabl: OFF ? on
Rel4 Td above: 0.00 'C ? 20
Rel4 Td below: 0.00 'C ? -
Rel4 Td hyst : 0.00 'C ? 2
Rel4 Td enabl: OFF ? on
>
```

Example of using relay 1 as fault alarm: selecting relay 1 to follow the fault status and relay 2 to follow the temperature measurement.

```plaintext>
> rsel fault t
Rel1 FAUL above: -
Rel1 FAUL below: -
Rel1 FAUL hyst : -
Rel1 FAUL enabl: ON ?
Rel2 T above: 0.00 'C ? 30
Rel2 T below: 0.00 'C ? -
Rel2 T hyst : 0.00 'C ? 2
Rel2 T enabl: OFF ? ON
>
```
Testing Operation of Relays

Testing activates relays even if they are disabled.

Use the module push buttons to activate the relays. Press the REL 1 or REL 2 button to activate the corresponding relay.

Relay is activated: led is lit
Relay is not activated: led is not lit

Use the display/keypad to test the operation of relays.

1. Open the Main Menu by pressing any of the arrow buttons.
2. Select System, press the ►arrow button.
3. Select Diagnostics, press the ►arrow button.
4. Select Relay tests, press the ►arrow button.
5. Select Invert relay 1..., press TEST. Now the selected relay output is forced to opposite state. Press OK to return to normal operation.
6. Press EXIT to return to the basic display.

RTEST

Use the serial line command RTEST to test the operation of the relays.

RTEST [x1 x2 x3 x4]<cr>

where

x = ON/OFF

Example: Activate and then release all four relays.

> rtest on on on on
  ON ON ON ON
> rtest off off off off
  OFF OFF OFF OFF
> 

Enter the command RTEST without parameters to stop testing.
Sensor Functions

Chemical Purge (Optional)

In some specific applications the sensor gain may decrease gradually due to an interference caused by a particular chemical present in the measured gas, for example. The decrease of sensor gain due to an interfering chemical and the effect of the chemical purge process are illustrated below, see Figure 66 below. The sensor polymer absorbs the interfering chemical, and this reduces the ability of the polymer to absorb water molecules. Consequently the sensor gain decreases. In chemical purge, heating the humidity sensor to a temperature level of approximately +160 °C for several minutes evaporates the interfering chemical.

The purge function starts with heating stage, continues with settling and when the temperature of the sensor is decreased the transmitter returns to normal mode. The whole cycle takes about 6 minutes.

NOTE

Chemical purge function locks the output values for about 6 minutes.

Figure 66 Decrease of Sensor Gain
Before starting the chemical purge, note the following:

- The sensor is protected with a PPS grid with stainless steel netting, a stainless steel sintered filter or with membrane SST filter.
- The sensor temperature must be below 100 °C. At higher temperatures the chemicals evaporate spontaneously from the sensor and the chemical purge is not necessary.
- Subzero temperatures slow down the recovery of the sensor after the chemical purge. The sensor is completely dry after the purge, and in very cold temperatures it can take more than two hours for it to reach ambient humidity again.

**Automatic Chemical Purge (Interval Purge)**

When HMT330 leaves the factory the automatic chemical purge (if chosen) takes place repeatedly with the time intervals set in the factory. User can change the interval in which the purge takes place by using serial commands or with the optional display/keypad. This can be needed if the measuring environment contains high concentrations of interfering chemicals. The automatic chemical purge can also be turned off if necessary.

**Manual Chemical Purge**

The chemical purge should be performed always before calibration (see section Calibration and Adjustment on page 155) or when there is a reason to believe that a sensor has become exposed to an interfering chemical. Make sure that the temperature of the sensor has come down to normal temperature before starting a calibration.

**Chemical Purge in Power Up**

Chemical purge (start-up purge) can be set to start within 10 seconds from the power-up of the device.
Starting and Configuring Chemical Purge

Using Buttons on Motherboard

Start manual chemical purge by pressing simultaneously two PURGE buttons on the motherboard inside the transmitter for a few seconds. Indicator LED flashes until purge is complete (up to 6 minutes).

Using Display/Keypad (Optional)

1. Open the Main Menu by pressing any of the ▼▲◄► arrow buttons.
2. Select ►Measuring, press ►button.
3. Select ►Chemical purge, press ►button.

Figure 67 Purge Buttons on Motherboard

- Start the chemical purge manually by selecting Start purge now and pressing START.
- Select Purge on power-up by using the arrow buttons. Press On/Off to turn the start-up purge on/off.
- Turn on/off the automatic purge by selecting Automatic purge, press ►ON/OFF button.
- Set the automatic purge interval by selecting Interval: ..., press SET. Set the purge interval and the unit (hour/day) by using the arrow buttons. The interval must be 1 hour ... 10 days. Press OK.
- If you have the data logger module installed, you can also specify the **Date** and **Time** when the purge is performed next.

4. Press **EXIT** to return to the basic display.

![Chemical Purge in progress...]

**Figure 69 Performing Chemical Purge**

### Using Serial Line

**PURGE**

Use the **PURGE** command to start chemical purge immediately.

```
purge
Purge started, press any key to abort.
```

The prompt ‘>’ appears when the heating period is over. However, the transmitter outputs are locked to the values measured before performing chemical purge until the settling time is over.

**PUR**

With **PUR** command you can enable or disable automatic and power-up chemical purge and set the interval for automatic purge. If the sensor is exposed to chemicals it is recommended to have the chemical purge done at least once in 720 min (=12 hours). In applications where the chemical exposure is not likely, the interval can be longer.

If the transmitter has a data logger module installed, you can also set the starting date and time for the interval purge. After the set time has been reached, the interval purge will be performed at the set interval. This functionality can be used to make sure the chemical purge starts at a specific time of the day.

Do not change the settings for duration, settling, temperature or temperature difference unless instructed by Vaisala personnel.

Type **PUR** and press ENTER to proceed. Skip unchanged values by pressing ENTER. Input changed values in the format shown by the current value (for example, date and time). The maximum interval is 14400 minutes (=10 days).
Example (no data logger module installed):

```bash
>pur
Interval Purge : OFF ?
Interval       : 720 min ?
Power-up Purge : OFF ?
Duration       : 120 s ?
Settling       : 240 s ?
Temperature    : 160 °C ?
Temp. diff.    : 0.5 °C ?
>
```

Example (with data logger module installed):

```bash
>pur
Interval Purge : OFF ?
Interval       : 720 min ?
Next Purge date: 2011-02-09 ?
Next Purge time: 12:00:00 ?
Power-up Purge : OFF ?
Duration       : 120 s ?
Settling       : 240 s ?
Temperature    : 160 °C ?
Temp. diff.    : 0.5 °C ?
>
```

**NOTE**
To activate the new interval settings immediately, reset the transmitter.

**NOTE**
When chemical purge in power-up is enabled, wait about 6 min after power up before taking measurements. The output channels are locked for the first operation minutes to the initial measured values.

**RGLIMIT**
Use the `RGLIMIT` command to prevent the chemical purge in subzero temperatures.

`RGLIMIT [ON/OFF]<cr>`

where

ON = Chemical purge disabled in < 0 °C temperatures.
OFF = Chemical purge allowed in < 0 °C temperatures.

Example (turn on the limiter and prevent purge in subzero temperatures):

```bash
>rglimit on
No purge if <0'C: ON
>
```
Sensor Heating

This function is optionally available only in transmitters with HUMICAP®180C or HUMICAP®180RC sensor. It should be used only with the warmed probe.

The sensor heating is recommended for the high humidity environments where even small temperature differences can cause water to condense on the sensor. The sensor heating speeds up the recovery of the humidity sensor from condensation.

Sensor heating starts-up when the relative humidity of the measuring environment reaches the RH-value set by a user (RH-limit). The user can define the RH-sensor heating temperature as well as the duration of the heating.

After the heating cycle the humidity conditions are checked and new sensor heating is performed if the predefined conditions are reached again.

NOTE

During the sensor heating the outputs are locked to the values measured before the heating cycle.

Setting Humidity Sensor Heating

When the HMT330 leaves the factory the sensor heating follows the factory default values. You can enable/disable the function, change the RH-limit and define the heating temperature and duration of this function.

XHEAT

Enables/disables the sensor heating.

**XHEAT [xx]<cr>**

where:

xx = ON / OFF

Example:

> xheat on
Extra heat : ON
> xheat off
Extra heat : OFF
>
To configure the sensor heating use the **XHEAT** command without parameters. Enter the values after question mark. The available ranges include the following:

- **Extra heat RH -limit (heating function starts-up above the setpoint)**: 0 ... 100 %RH (default: 95 %RH)
- **Extra heating temperature**: 0 ... 200 °C (default: 100 °C)
- **Extra heating time**: 0 ... 255 s (default: 30 s)

**Example:**

```
> xheat
Extra heat     : OFF
Extra heat RH  : 95 ? 90
Extra heat temp: 100 ? 85
Extra heat time: 30 ? 10
> xheat on
Extra heat     : ON
>
```
This page intentionally left blank.
CHAPTER 5
MODBUS

This chapter contains information that is needed when operating the transmitter using the Modbus protocol.

Overview of Modbus Protocol Support

The HMT330 transmitter can be accessed using the Modbus serial communication protocol. Support for Modbus protocol is available on all HMT330 transmitters as a standard feature from software version 5.10 onward. The supported Modbus variants and the connections they use are listed in Table 32 below.

Table 32 Supported Modbus Variants

<table>
<thead>
<tr>
<th>Supported Modbus Variant</th>
<th>Connections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modbus RTU (Serial Modbus)</td>
<td>RS-232 (standard User Port)</td>
</tr>
<tr>
<td></td>
<td>RS-422/485 interface (optional module)</td>
</tr>
<tr>
<td>Modbus TCP (Ethernet Modbus)</td>
<td>LAN interface (optional module)</td>
</tr>
<tr>
<td></td>
<td>WLAN interface (optional module)</td>
</tr>
</tbody>
</table>

The supported Modbus functions, registers, configuration options, and diagnostics are described in Appendix C, Modbus Reference, on page 199.

Note the following limitations of the Modbus implementation:

- Modbus TCP mode accepts only one TCP connection at a time. Design the system so that only one Modbus TCP client accesses the transmitter.
- Modbus TCP can process reliably only one Modbus transaction at a time. Reduce the polling rate of the client to avoid nested transactions.
Taking Modbus into Use

To take the Modbus protocol into use on the HMT330, you must perform some configuration tasks using the built-in display and keypad (optional) or a PC connected to the serial line. For example, you can connect to the service port using the USB service cable (Vaisala order code: 219685). The transmitter must be powered from a suitable power supply during configuration.

Instructions for performing the configuration are provided in the following sections:

- Enabling Serial Modbus on page 143
- Enabling Ethernet Modbus on page 144

After configuring the transmitter, perform the transmitter installation and wiring according to the instructions in Chapter 3, Installation, on page 27.

The configuration instructions assume you are familiar with the use of the transmitter. Additional details on the display/keypad, service port use, and serial commands are available in other sections of this manual:

- The use of the display/keypad option is described in section Display/Keypad (Optional) on page 67.
- If this is the first time you are using the USB service cable, you can find detailed instructions in section Service Port Connection on page 81. You must install the required driver before using the service cable.
- Configuration of the LAN and WLAN interfaces is described in section LAN Communication on page 82.
- The serial commands available through the service port are described beginning from section List of Serial Commands on page 93.
Enabling Serial Modbus

In addition to enabling the Modbus protocol in the device, Modbus over RS-232 or RS-485 needs the following software settings: serial bit rate, parity, number of stop bits, and Modbus device address.

Using Display/Keypad (Optional)

1. Open the Main Menu by pressing any of the ▼ ▲ ◄ ► arrow buttons.
2. Navigate to Interfaces ► Serial Interface.
3. On the Serial Interface settings screen:
   - Enable the Modbus protocol.
   - Change the baud rate and parity if necessary.
   - Set the Modbus device address.

![Serial Interface Settings](image)

4. After changing the settings, press the EXIT button. The Modbus configuration is now complete, as configuration changes made with the display and keypad are effective immediately.

Using Serial Line

1. Open the transmitter cover.
2. Connect power supply wiring (if not using the power supply module) and power up the transmitter.
3. Connect the USB service cable between a computer and the service port of the transmitter.
4. Start the Vaisala USB Instrument Finder program (which has been installed on the computer along with the USB service cable driver), and check the COM port that the cable is using.
5. Open a terminal program, and connect to the service port. The fixed serial line settings of the service port are 19200, 8, 1, N.
6. Use the SMODE command to enable the Modbus mode:

   >smode modbus
   Serial mode    : MODBUS
   >

7. If necessary, use the SERI command to check and/or change the serial interface settings for the User Port. For example, to set the User Port serial settings to 19200 N 8 1, issue the following command:

   >seri 19200 N 8 1

**NOTE**
The number of data bits must always be 8 for Modbus RTU.
Serial Modbus interface of the HMT330 does not work with baud rates 115, 150, and 300 b/s.

8. Use the ADDR command to set the Modbus address of the transmitter. For example, to set the Modbus address to 52, issue the following command:

   >addr 52

   You must set a non-zero address or Modbus RTU will not work.

9. The Modbus configuration is now complete. Reset or power cycle the transmitter to enable the Modbus mode, and proceed with the installation of the transmitter and the wiring of the serial interface.

**Enabling Ethernet Modbus**

In addition to enabling the Modbus protocol in the device, Modbus TCP needs the following software settings: IP address, subnet mask, and default gateway address. Also network name (SSID) and security settings must be configured if wireless network is used.

**Using Display/Keypad (Optional)**

1. Open the Main Menu by pressing any of the ▼▲◄► arrow buttons.
2. Navigate to Interfaces ► Network Settings ► IP Configuration.
3. On the IP Configuration screen, set the network configuration settings, and exit to save the changes.
4. Navigate back to the **Network Settings** menu. If you are using the WLAN interface, select **Wireless LAN Settings**.

5. On the **Wireless LAN Settings** screen, set the network name (SSID) and security options, and exit to save the changes.

6. Navigate back to the **Network Settings** menu. Select **Communication Protocol**.

7. On the **Communication Protocol** screen, enable the Modbus protocol. Press the **EXIT** button to save the changes.

   Note that the device address setting is not relevant for Modbus TCP. In the Modbus mode, the transmitter will respond to all valid Modbus messages with any “unit identifier” value.

8. The Modbus configuration is now complete, as configuration changes made with the display and keypad are effective immediately.
Using Serial Line

1. Open the transmitter cover.

2. Connect power supply wiring (if not using the power supply module) and power up the transmitter.

3. Connect the USB service cable between a computer and the service port of the transmitter.

4. Start the Vaisala USB Instrument Finder program (which has been installed on the computer along with the USB service cable driver), and check the COM port that the cable is using.

5. Open a terminal program, and connect to the service port. The fixed serial line settings of the service port are 19200, 8, 1, N.

6. Use the SMODE command to enable the Modbus mode:

   > smode modbus
   serial mode    : MODBUS
   >

7. Configure the networking parameters of the interface you are using:

   **NOTE**
   After transmitter startup, it may take a few minutes for the network interface to become available for configuration.

   a. Use the NET command to configure the networking parameters of both LAN and WLAN interface. You can, for example, enter the command without parameters and enter the settings as prompted:

   ```
   > net
   DHCP           : ON ? OFF
   IP address     : 0.0.0.0 ? 143.154.142.102
   Subnet mask    : 0.0.0.0 ? 255.255.0.0
   Default gateway: 0.0.0.0 ?
   Web config.    : ON ? OFF
   Save changes (Y/N) ? y
   OK
   >
   ```
b. If you are using the WLAN interface, use the `WLAN` command to configure the network name (SSID) and security settings. For example:

```wlan
Network SSID   : NAME ? NETWORKID
Type           : OPEN ? WPA-PSK/TKIP
WPA-PSK phrase : thequickbrownfox
Save changes (Y/N) ? y
```

OK
>

For a description of the available settings, see section Wireless LAN Configuration on page 86.

8. The Modbus configuration is now complete. Reset or power cycle the transmitter to enable the Modbus mode, and proceed with the installation of the transmitter.

**Diagnostic Modbus Counters**

HMT330 has diagnostic counters that can be used to pinpoint Modbus problems. The counters are always active when the Modbus protocol is enabled.

**Viewing Counters Using Display/Keypad**

You can use the display/keypad option to view and clear the counters. Enter the **Main Menu** and navigate to System ➤ **Diagnostics** ➤ **MODBUS Counters**.

![Diagnostic Modbus Counters](1101-037)

**Figure 74** Modbus Counters
Viewing Counters Using Service Port

Use the MODBUS command to view the counters:

MODBUS<cr>

Example:

>modbus
Bus messages  : 0
Bus comm. error: 0
Bus exceptions : 0
Slave messages : 0
Slave no resp. : 0
Last message   :
>

In addition to the diagnostic counters, the last message (received or transmitted) is shown in hexadecimal format. If the last message was a broadcast message, the suppressed response message is shown.

The last message displayed may be incomplete if there is active Modbus traffic while using the MODBUS command.

Modbus RTU only: If the last received message was rejected because of bad CRC checksum, the MODBUS command displays the message with corrected CRC (last two bytes updated).

To clear the counters, select again the Modbus mode with the SMODE command:

>smode modbus

Disabling Modbus

If you stop using Modbus with the transmitter, set the transmitter to some other operating mode using the display/keypad option or the SMODE command.

For example, to return the transmitter to the RUN mode where the measurements are output at regular intervals, issue the following command through the service port:

>smode run

Alternatively, you can enter the Main Menu using the display/keypad option, and change the mode from the Interfaces submenu.

The other communication settings of the output interface (User Port, LAN interface, or WLAN interface) will remain as configured, but the Modbus protocol will be disabled.
CHAPTER 6
MAINTENANCE

This chapter contains information that is needed in basic maintenance of the product.

Periodic Maintenance

Cleaning

Clean the transmitter enclosure with a soft, lint-free cloth moistened with mild detergent.

Changing the Probe Filter

1. Turn the filter counter-clockwise to loosen it.
2. Remove the filter from the probe. Be careful not to touch the sensor with the filter. Without the filter in place, the sensor is easily damaged – handle the probe carefully.
3. Install a new filter on the probe. When using the stainless steel filter (for fuel cell applications), take care to tighten the filter properly (recommended force 5 Nm).

New filters can be ordered from Vaisala, see section Spare Parts and Accessories on page 178.
Changing the Sensor

NOTE

When replacing the sensor, the new sensor must be of the same type as the old sensor (for example, HUMICAP180R). The sensor type can only be changed at a Vaisala Service Center. Information on Vaisala sensors is available online at www.vaisala.com/sensorinfo.

Changing HUMICAP180 and HUMICAP180R humidity sensors is simple. If the transmitter has the chemical purge and/or warmed probe option which utilize the HUMICAP180C or HUMICAP180RC sensor, the change is more difficult as soldering is required to attach the pins of the integrated temperature sensor element. Vaisala recommends that you leave the replacement of HUMICAP180C and HUMICAP180RC sensors to Vaisala Service Centers, but spare parts are available if you want to do it yourself. Soldering instructions are not provided.

Changing the sensor should be considered corrective maintenance, and it is not necessary in normal operation. If the accuracy of the transmitter does not seem to be within specification, it is more likely that the transmitter is in need of calibration and adjustment, and not sensor replacement. Refer to chapter Calibration and Adjustment on page 155.

To replace the HUMICAP180 or HUMICAP180R sensor:

1. Remove the filter from the probe. See the instructions in section Changing the Probe Filter on page 149.
2. Remove the damaged sensor and insert a new one. Handle the new sensor by the plastic socket. DO NOT TOUCH THE SENSOR PLATE.
3. Perform a calibration and adjustment as instructed in section Relative Humidity Adjustment after Sensor Change on page 161.
4. Attach a new filter on the probe. When using the stainless steel filter, take care to tighten the filter properly (recommended force 5 Nm).

Figure 75 Changing the Sensor

1 = Pull out the sensor
2 = Plastic socket
Error States

In error state the affected quantities are not measured and the output is shown as follows:

- Analog channel outputs 0 mA or 0 V (you can use the serial line command AERR or display/keypad to change this fault indication value, see section Analog Output Fault Indication Setting on page 124.).
- Serial port outputs stars "***" instead of measurement data.
- Display shows "----" instead of measurement data.
- Cover LED is blinking.
- Error indicator is shown on the display.

![Error Indicator and Error Message](image)

Figure 76   Error Indicator and Error Message

The following number refers to Figure 76 above:

1   =   Error indicator

The error indicator disappears when the error state is over and you have checked the error message. Press the INFO button to display the error message.

You can also check the error message via the serial interface by using the command ERRS. In case of constant error, please contact Vaisala. See section Technical Support on page 153.
<table>
<thead>
<tr>
<th>Error Code</th>
<th>Error Message</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>E0</td>
<td>Humidity sensor measurement malfunction.</td>
<td>Check the integrity of the humidity probe and the probe cable. Clean the probe from dirt, water, ice or other contaminants.</td>
</tr>
<tr>
<td>E1</td>
<td>Humidity sensor short circuit.</td>
<td></td>
</tr>
<tr>
<td>E2</td>
<td>Humidity sensor open circuit.</td>
<td></td>
</tr>
<tr>
<td>E3</td>
<td>Temperature sensor open circuit.</td>
<td></td>
</tr>
<tr>
<td>E4</td>
<td>Temperature sensor short circuit.</td>
<td></td>
</tr>
<tr>
<td>E5</td>
<td>Temperature measurement malfunction.</td>
<td></td>
</tr>
<tr>
<td>E6</td>
<td>Temperature sensor current leak.</td>
<td></td>
</tr>
<tr>
<td>E7</td>
<td>Internal ADC read error</td>
<td>Internal transmitter failure. Remove the transmitter and return the faulty unit to Vaisala Service.</td>
</tr>
<tr>
<td>E8</td>
<td>Additional temperature sensor short circuit</td>
<td>Check the integrity of the temperature probe and the probe cable. Clean the probe cable from dirt, water, ice or other contaminants.</td>
</tr>
<tr>
<td>E9</td>
<td>Checksum error in the internal configuration memory</td>
<td>Internal transmitter failure. Remove the transmitter and return the faulty unit to Vaisala Service.</td>
</tr>
<tr>
<td>E10</td>
<td>Internal EEPROM read error</td>
<td></td>
</tr>
<tr>
<td>E11</td>
<td>Internal EEPROM write error</td>
<td></td>
</tr>
<tr>
<td>E12 ... E13</td>
<td>Add-on module 1 (or 2) connection failure</td>
<td>Turn off the power and check the module connection. Turn on the power.</td>
</tr>
<tr>
<td>E14</td>
<td>Device internal temperature out of range</td>
<td>Ensure that the operating temperature is within the valid range.</td>
</tr>
<tr>
<td>E15</td>
<td>Internal RAM memory or software checksum error</td>
<td>Internal transmitter failure. Remove the transmitter and return the faulty unit to Vaisala Service.</td>
</tr>
<tr>
<td>E18</td>
<td>Internal ADC reference voltage out of range</td>
<td>Internal transmitter failure. Remove the transmitter and return the faulty unit to Vaisala Service.</td>
</tr>
<tr>
<td>E19</td>
<td>Internal analog output reference voltage out of range</td>
<td>Internal transmitter failure. Remove the transmitter and return the faulty unit to Vaisala Service.</td>
</tr>
<tr>
<td>E20 ... E22</td>
<td>Configuration switches for analog output 1/2/3 set incorrectly</td>
<td>Check and re-set the switches, see page 55.</td>
</tr>
<tr>
<td>E24 ... E25</td>
<td>Internal error in add-on module 1 (or 2)</td>
<td>Disconnect the power and check the module connection.</td>
</tr>
<tr>
<td>E26</td>
<td>Communication module installed in incorrect add-on module slot</td>
<td>Disconnect the power and change the communication module to another module slot.</td>
</tr>
<tr>
<td>E28 ... E29</td>
<td>Unknown/incompatible module installed in add-on module slot 1 (or 2)</td>
<td>Ensure that the module is compatible with the HMT330.</td>
</tr>
<tr>
<td>E30</td>
<td>Internal analog voltage out of range</td>
<td>Internal transmitter failure. Remove the transmitter and return the faulty unit to Vaisala Service.</td>
</tr>
<tr>
<td>E31</td>
<td>Internal system voltage out of range</td>
<td>Check that the supply voltage is correct and the power supply can provide enough power for the instrument.</td>
</tr>
</tbody>
</table>
Technical Support

For technical questions, contact the Vaisala technical support by e-mail at helpdesk@vaisala.com. Provide at least the following supporting information:

- Name and model of the product in question
- Serial number of the product
- Name and location of the installation site
- Name and contact information of a technically competent person who can provide further information on the problem.

Product Returns

If the product must be returned for service, see www.vaisala.com/returns.

For contact information of Vaisala Service Centers, see www.vaisala.com/servicecenters.
This page intentionally left blank.
The HMT330 is fully calibrated and adjusted as shipped from factory. Typical calibration interval is one year. Depending on the application it may be good to make more frequent checks. Calibration must be done always when there is a reason to believe that the device is not within the accuracy specifications.

It is recommended that calibration and adjustment should be carried out by Vaisala. For contact information of Vaisala Service Centers, see [www.vaisala.com/servicecenters](http://www.vaisala.com/servicecenters).

Calibration and adjustment is carried out either by using the push-keys on the motherboard, through the serial port or with the optional display/keypad.

(Vaisala portable instruments HM70 and HMI41 can also be used).

### Opening and Closing the Adjustment Mode

1. Open the transmitter cover. The buttons needed in adjustment are on the left-hand side of the motherboard.
2. If the chemical purge option is available, it should be carried out always before calibration. To start chemical purge press simultaneously two **PURGE** push-keys (on the motherboard) for a few seconds. Red indicator LED flashes with short pulses until purge is complete (up to 6 minutes).
3. Press the **ADJ** key to open the adjustment mode.
4. Press the **ADJ** key again to close the adjustment mode.
**Figure 77 Adjustment and Purge Buttons**

The following numbers refer to Figure 77 above:

1 = Indicator LED  
2 = Adjustment button  
3 = Press the purge buttons simultaneously to start chemical purge (if available)

Adjustment menu is displayed only when ADJ button (on the motherboard inside the transmitter) is pressed.

![Adjustment Menu Diagram](image)

**Figure 78 Adjustment Menu**

**Table 34 Indicator Led Functions**

<table>
<thead>
<tr>
<th>Indicator Led Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED off</td>
<td>adjustment locked</td>
</tr>
<tr>
<td>LED on</td>
<td>adjustment available</td>
</tr>
<tr>
<td>LED blinking evenly</td>
<td>measurement not stabilized</td>
</tr>
<tr>
<td>LED blinking with short pulses</td>
<td>performing chemical purge</td>
</tr>
</tbody>
</table>

**NOTE**

If using a warmed probe (HMT337 option), probe heating will be interrupted when ADJ key is pressed. Allow sufficient time for the probe to reach ambient temperature before starting the adjustment procedure.

**NOTE**

Fixed pressure compensation value of 1013.25 hPa is used when in adjustment mode.
Relative Humidity Adjustment

Using Push Buttons

A simple push-button adjustment is carried out by using two relative humidity references: 11 %RH (LiCl) and 75 %RH (NaCl).

1. Carry out the chemical purge (if available).

LiCl reference

2. Press the ADJ button (see Figure 77 on page 156) on the motherboard to open the adjustment mode. The indicator LED starts flashing.

3. Remove the filter from the probe and insert the probe into a measurement hole of the 11 %RH (LiCl) in the humidity calibrator HMK15. Use the adapter fitting for the probes of HMT334, HMT335, HMT337 and HMT338.

4. Wait at least 30 minutes for the sensor to stabilize (the indicator LED is lit continuously). Adjustment cannot be done if the conditions are not stabilized (indicator LED is flashing).

5. When the indicator LED is lit continuously, press the button LiCl~11% to adjust the 11 %RH condition. After adjustment transmitter returns to normal operation mode (indicator LED is unlit).

NaCl reference

6. When adjusting in the second reference 75 %RH, press the ADJ button to open the adjustment mode. The indicator LED starts flashing.

7. Insert the probe into a measurement hole of the 75 %RH (NaCl) reference chamber of the humidity calibrator HMK15. Use the adapter fitting for the probes of HMT334, HMT335, HMT337 and HMT338.

8. Wait at least 30 minutes for the sensor to stabilize (the indicator LED is lit continuously). Adjustment cannot be done if the conditions are not stabilized (indicator LED is flashing).

9. Press the button NaCl 75 % to adjust the 75 %RH condition. After adjustment transmitter returns to normal operation mode (indicator LED is unlit).
Using Display/Keypad

Note that the difference between the two humidity references must be at least 50 %RH.

1. Carry out the chemical purge (if available).
2. Press the ADJ button (opens the ADJUSTMENT MENU).
3. Select Adjust RH measurement, press ► button.
4. Select 1-point/ 2-point adjustment, press START.
5. Select the reference as guided by the display, press SELECT.

![Figure 79 Selecting Point 1 Reference Type](0706-005)

6. Remove the filter from the probe and insert the probe into a measurement hole of the dry end reference chamber (for example, LiCl: 11 %RH in the humidity calibrator HMK15.) Use the adapter fitting for the probes of HMT334, HMT335, HMT337 and HMT338.
7. Wait at least 30 minutes for the sensor to stabilize. Follow the stabilization from the GRAPH display.
8. Press READY when stabilized. If you have chosen the Other reference value, enter now the reference value by using the arrow buttons.

When carrying out the 2-point adjustment proceed to the next adjustment point and carry out the procedure as described in the previous steps.
9. Press YES to confirm the adjustment. Press OK to return to the adjustment menu.
10. Press EXIT to close the adjustment mode and return to the basic display. Before closing the adjustment mode, feed the adjustment information into the device, see section Feeding Adjustment Information on page 168.
Using Serial Line

Note that the difference between the two humidity references must be at least 50 %RH.

1. Connect the HMT330 to a PC. See section Serial Line Communication on page 79. Open a terminal program.
2. Carry out the chemical purge (if available).
3. Press the ADJ button.
4. Remove the filter from the probe and insert the probe into a measurement hole of the dry end reference chamber (for example, LiCl: 11 %RH in the humidity calibrator HMK15). Use the adapter fitting for the probes of HMT334, HMT335, HMT337 and HMT338.
5. Enter the CRH command and press ENTER.

```
> crh
```

6. Wait at least 30 minutes for the sensor to stabilize.
7. Type C and press ENTER a few times to check if the reading is stabilized.
8. When the reading is stabilized, give the reference humidity after the question mark and press ENTER.

```
> crh
RH : 11.25 Ref1 ? c
RH : 11.25 Ref1 ? c
RH : 11.25 Ref1 ? c
RH : 11.24 Ref1 ? c
RH : 11.24 Ref1 ? 11.3
Press any key when ready ...
```

9. Now the device is waiting for the high end reference. Insert the probe into the measurement hole of the high end reference chamber (for example, NaCl: 75 %RH chamber in the humidity calibrator HMK15). Use the adapter fitting for the HMT334, HMT335, HMT337 and HMT338 probes. Press any key when ready.
10. Let the probe stabilize for about 30 minutes. You can follow the stabilization by typing C and pressing ENTER.
11. When stabilized, type the high end reference value after the question mark and press **ENTER**.

```
> crh
RH :  11.25  Ref1 ? c
RH :  11.24  Ref1 ? c
RH :  11.24  Ref1 ? 11.3
Press any key when ready ...

RH :  75.45  Ref2 ? c
RH :  75.57  Ref2 ? c
RH :  75.55  Ref2 ? c
RH :  75.59  Ref2 ? 75.5
OK
>
```

12. **OK** indicates that the adjustment has succeeded and the new calibration coefficients are calculated and stored. Enter the adjustment information (date and text) to the memory of the transmitter; see the commands **CTEXT** and **CDATE**.

13. Press the **ADJ** button on the motherboard to close the adjustment mode.

14. Take the probe out of the reference conditions and replace the filter.
Multipoint Adjustment Using Serial Line

You can use the MPC command (introduced in software version 5.14) to perform a multipoint adjustment to the relative humidity measurement. Due to the linear response of the HUMICAP® sensor, the standard two point adjustments are recommended for all users. Use multipoint correction only if:

- You have a requirement to adjust the relative humidity measurement in 3 ... 6 adjustment points.
- You are interested in a narrow range of measurement and want to optimize the RH measurement performance for that range.

Multipoint adjustment works by means of a correction table that holds 2 ... 6 adjustment points. The idea is that for every point, you enter the RH reading that the transmitter shows, and the correct humidity reference value. You can select any references points in range 0 ... 100 %RH, but Vaisala recommends that the difference between the lowest and highest reference point is at least 50 %RH.

**NOTE**

Multipoint adjustment is applied “on top” of the standard user-made two point adjustment (done with CRH command, push-buttons, or display). It is recommended that before you start using the MPC command, you clear the existing humidity adjustment. This is done as part of the example multipoint adjustment procedure provided here.

### MPC Command Syntax

```
MPC [quantity] [function]<cr>
```

where

- **quantity** = Quantity to be adjusted. The only available quantity is RH.
- **function** = Desired function. The options are:
  - ON – Enable multipoint correction.
  - OFF – Disable multipoint correction.
  - LIST – Show correction table.
  - INIT – Start entering values in correction table.
  - CLEAR – Remove all values from correction table and disable multipoint correction.
Example Multipoint Adjustment Procedure

1. Connect the HMT330 to a PC. See section Serial Line Communication on page 79. Open a terminal program.

2. Issue the PURGE command to carry out the chemical purge, and wait for six minutes for it to complete. Transmitters without the chemical purge feature will not respond to the command.

```plaintext
>purge
Purge started, press any key to abort...
```

3. Press the ADJ button on the component board.

4. View the currently applied standard user adjustment offset and gain using the L command. If offset is zero and gain is one (example shown below), no user correction is applied:

```plaintext
>l
RH offset : 0.00000000E+00
RH gain : 1.00000000E+00
T offset : 0.00000000E+00
T gain : 1.00000000E+00
```

5. If some RH offset or gain is applied, write down the adjustment and then clear it by writing zero to RH offset and one to RH gain using the LI command:

```plaintext
>li
RH offset : 0.001300000E+00 ? 0
RH gain : 1.040000000E+00 ? 1
T offset : 0.000000000E+00 ?
T gain : 1.000000000E+00 ?
```

6. You must now prepare a list of 3 ... 6 correction points using a humidity generator or salt solutions (for example, using the HMK15 Humidity Calibrator). You must measure the transmitter’s RH reading at each point, and make a note of the reference RH reading. Here is an example list for a four-point correction:

<table>
<thead>
<tr>
<th>Point Number</th>
<th>Transmitter’s Reading</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12.2 %RH</td>
<td>11 %RH</td>
</tr>
<tr>
<td>2</td>
<td>34 %RH</td>
<td>33 %RH</td>
</tr>
<tr>
<td>3</td>
<td>75.5 %RH</td>
<td>75 %RH</td>
</tr>
<tr>
<td>4</td>
<td>97.3 %RH</td>
<td>97 %RH</td>
</tr>
</tbody>
</table>
To start, remove the filter from the probe and insert the probe into a measurement hole of the driest reference chamber you intend to use. Proceed from low to high humidity. Remember to allow at least 30 minutes for the sensor to stabilize at each point.

7. When done preparing the list, remove the probe from the last measurement chamber and re-attach the filter.

8. On the serial line, issue the MPC RH INIT command and start entering the readings and reference points from the list you prepared in step 6. When you have no more points to enter, press enter to save the points.

   > mpc rh init
   1 Reading : ? 12.2
   1 Reference: ? 11
   2 Reading : ? 34
   2 Reference: ? 33
   3 Reading : ? 75.5
   3 Reference: ? 75
   4 Reading : ? 97.3
   4 Reference: ? 97
   5 Reading : 

   Mpc points saved.

9. Issue the MPC RH LIST command to verify the list you entered:

   > mpc rh list
   MPC            : OFF
   #    Reading  Reference Correction
   1      12.20      11.00      -1.20
   2      34.00      33.00      -1.00
   3      75.50      75.00      -0.50
   4      97.30      97.00      -0.30

10. If you are satisfied with the correction list, enable multipoint correction by issuing the command MPC RH ON.

   > mpc rh on

11. Multipoint adjustment is now complete.
Relative Humidity Adjustment after Sensor Change

Using Display/Keypad

When using the optional display/keypad, follow the instructions in section Using Display/Keypad on page 158 but select Adj. for new RH sensor (instead of 1-point/ 2-point adjustment).

Using Serial Line

After sensor change, carry out the procedure as described in previous sections. Just replace the CRH command with the FCRH command.

FCRH

Example:

>fcrh
RH :  1.82  1. ref ?  0
Press any key when ready...
RH :  74.22  2. ref ?  75
OK
>

The OK indicates that the calibration has succeeded.
Temperature Adjustment

Using Display/Keypad

1. Press the ADJ button on the motherboard to open the ADJUSTMENT MENU. If using a warmed probe for measuring, probe heating will be interrupted when ADJ key is pressed. Wait some time for the probe to reach ambient temperature.
2. Select ►Adjust T measurement, press ► key.
3. Select 1-point/ 2-point adjustment, press START.
4. Remove the filter from the probe and insert the probe into the reference temperature.
5. Wait at least 30 minutes for the sensor to stabilize. Follow the stabilization from the GRAPH display.
6. Press READY when stabilized. Give the reference temperature using the arrow buttons.

When carrying out the 2-point adjustment, proceed to the next adjustment point and carry out the procedure as described in the previous item. Note that the difference between the two temperature references must be at least 30 ºC.

7. Press OK. Press YES to confirm the adjustment.
8. Press OK to return to the adjustment menu.
9. Press EXIT to close the adjustment mode and return to the basic display.

Using Serial Line

1. Press the ADJ key on the motherboard to open the adjustment mode. If using a warmed probe for measuring, probe heating will be interrupted when ADJ key is pressed. Wait some time for the probe to reach ambient temperature.
2. Remove the probe filter and insert the probe into the reference temperature.
3. Enter the command CT or (CTA for additional T probe) and press ENTER.

>ct

or for additional T probe:

>cta
4. Type `C` and press **ENTER** a few times to check if the reading is stabilized. Let the reading stabilize, give the reference temperature after the question mark and press **ENTER** three times.

When using two reference temperatures (2-point calibration) press **ENTER** only twice and insert the probe to the second reference. When the reading is stabilized, give the second reference temperature after the question mark and press **ENTER**. Please, note that the difference between the two temperature references must be at least 30 ºC.

Example (one-point adjustment):

```
>ct
T : 16.06 Ref1 ? c
T : 16.06 Ref1 ? c
T : 16.06 Ref1 ? c
T : 16.06 Ref1 ? c
T : 16.06 Ref1 ? c
T : 16.06 Ref1 ? c
Press any key when ready ...
T : 16.06 Ref2 ?
OK
> 
```

5. **OK** indicates that the calibration has succeeded. Enter the calibration information (date and text) to the transmitter's memory; see the serial commands **CTEXT** and **CDATE**.

6. Press the **ADJ** button on the motherboard to close the adjustment mode.

7. Take the probe out of the reference conditions and replace the filter.
Analog Output Adjustment

In the analog output calibration the analog output is forced to the following values:

- Current output: 2 mA and 18 mA
- Voltage output: 10 % and 90 % of the range

Connect HMT330 to a calibrated current/voltage meter in order to measure either current or voltage depending on the selected output type.

Using Display/Keypad

1. Press the ADJ button to open the ADJUSTMENT MENU.
2. Select Adjust analog outputs, press ► button.
3. Select the output to be adjusted Adjust analog output 1/2, press START.
4. Measure the first analog output value with a multimeter. Give the measured value by using the arrow buttons. Press OK.
5. Measure the second analog output value with a multimeter. Give the measured value by using the arrow buttons. Press OK.
6. Press OK to return to the adjustment menu.
7. Press EXIT to close the adjustment mode and to return to the basic display.

Using Serial Line

Enter the ACAL command and type the multimeter reading for each case. Continue by pressing ENTER.

ACAL

Example (current outputs):

>acal
Ch1  I1  (mA) ?  2.046
Ch1  I2  (mA) ?  18.087
Ch2  I1  (mA) ?  2.036
Ch2  I2  (mA) ?  18.071
>
Feeding Adjustment Information

This information is shown on the device information fields. See section Device Information on page 108.

**Using Display/Keypad**

1. If you are not in the adjustment menu, press the ADJ button on the motherboard (opens the ADJUSTMENT MENU).
2. Select Adjustment info, press the ► button.
3. Select Date, press SET. Give the date by using the arrow buttons. Press OK.
4. Select i, press SET. Enter information text including 17 characters at maximum by using the arrow buttons. Press OK.
5. Press EXIT to return to the basic display.

**Using Serial Line**

**CTEXT**

Use the CTEXT command to enter text to the adjustment information field.

Example:

```
>ctext
Adjust. info : (not set) ? HMK15
>
```

**CDATE**

Use the CDATE command to enter date to adjustment information field. Set the adjustment date in format YYYY-MM-DD.

Example:

```
>cdate
Adjust. date : (not set) ? 2004-05-21
>
```
CHAPTER 8
TECHNICAL DATA

This chapter provides the technical data of the product.

Specifications

Performance

Relative Humidity

Measurement range 0 ... 100 %RH
Accuracy (including non-linearity, hysteresis and repeatability)

with

| HUMICAP®180 | for typical applications |
| HUMICAP®180R | for typical applications |
| HUMICAP®180C | for applications with chemical purge and/or warmed probe |
| HUMICAP®180RC | for applications with chemical purge and/or warmed probe |

at +15 ... 25 °C

± 1 %RH (0 ... 90 %RH)
± 1.7 %RH (90 ... 100 %RH)

at -20 ... +40 °C

± (1.0 + 0.008 × reading) %RH

at -40 ... + 180 °C

± (1.5 + 0.015 × reading) %RH

Factory calibration uncertainty (+20 °C)

±0.6 %RH (0 ... 40 %RH)
±1.0 %RH (40 ... 97 %RH)
(Defined as ± 2 standard deviation limits. Small variations possible, see also calibration certificate.)

Response time (90 %) for HUMICAP®180 and HUMICAP®180C in still air

8 s with grid filter
20 s with grid + steel netting filter
40 s with sintered filter

Response time (90 %) for HUMICAP®180R and HUMICAP®180RC at 20 °C in 0.1 m/s air flow

17 s with grid filter
50 s with grid + steel netting filter
60 s with sintered filter
Temperature (+ Operating Pressure Ranges)

<table>
<thead>
<tr>
<th>Model</th>
<th>Temperature Range</th>
<th>Pressure Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMT331</td>
<td>-40 ... +60 °C</td>
<td>-40 ... +140 °F</td>
</tr>
<tr>
<td>HMT333 80 °C</td>
<td>-40 ... +80 °C</td>
<td>-40 ... +176 °F</td>
</tr>
<tr>
<td>HMT333 120 °C</td>
<td>-40 ... +120 °C</td>
<td>-40 ... +248 °F</td>
</tr>
<tr>
<td>HMT334</td>
<td>-70 ... +180 °C</td>
<td>0 ... 10 MPa (0 ... 100 bar)</td>
</tr>
<tr>
<td>HMT335 (vapor tight)</td>
<td>-70 ... +180 °C</td>
<td>-94 ... +356 °F</td>
</tr>
<tr>
<td>HMT337 (vapor tight)</td>
<td>-70 ... +180 °C</td>
<td>-94 ... +356 °F</td>
</tr>
<tr>
<td>HMT338</td>
<td>-70 ... +180 °C</td>
<td>0 ... 4 MPa (0 ... 40 bar)</td>
</tr>
</tbody>
</table>

Accuracy at +20 °C (+68 °F): ± 0.2 °C
Accuracy over temperature range (see graph below):

![Accuracy over Temperature Range](image)

**Figure 80**  Accuracy over Temperature Range

Temperature sensor: Pt100 RTD Class F0.1 IEC 60751

Optional Temperature Probe

Temperature measurement range: -70 ... +180 °C (-94 ... +356 °F)
Typical accuracy: 0.1 °C (0.18 °F)
Sensor: Pt100 PRT DIN IEC 751 class 1/4 B
Cable length: 2 m, 5 m, and 10 m
Pressure tight: Up to 7 bar
Probe material: Stainless steel
Calculated Variables

Table 36  Calculated Variables (Typical Ranges)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Variable</th>
<th>Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HMT331 Probe</td>
<td>HMT333 Probe</td>
</tr>
<tr>
<td>Dewpoint temperature</td>
<td>-20 ... +60 ºC</td>
<td>-20 ... +80 ºC</td>
</tr>
<tr>
<td>Mixing ratio</td>
<td>0 ... 160 g/kg dry air</td>
<td>0 ... 500 g/kg dry air</td>
</tr>
<tr>
<td>Absolute humidity</td>
<td>0 ... 160 g/m³</td>
<td>0 ... 500 g/m³</td>
</tr>
<tr>
<td>Wet bulb temperature</td>
<td>0 ... 60 ºC</td>
<td>0 ... +100 ºC</td>
</tr>
<tr>
<td>Enthalpy</td>
<td>-40 ... +1500 kJ/kg</td>
<td>-40 ... +1500 kJ/kg</td>
</tr>
<tr>
<td>Water vapor pressure</td>
<td>0 ... 1000 hPa</td>
<td>0 ... 1000 hPa</td>
</tr>
</tbody>
</table>

Accuracies of Calculated Variables

Accuracies of the calculated variables depend on the calibration accuracy of the humidity and temperature sensors; here the accuracies are given for ± 2 %RH and ± 0.2 ºC.

Accuracy of Dewpoint Temperature ºC

<table>
<thead>
<tr>
<th>Relative humidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temp.</td>
</tr>
<tr>
<td>-40</td>
</tr>
<tr>
<td>-20</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>20</td>
</tr>
<tr>
<td>40</td>
</tr>
<tr>
<td>60</td>
</tr>
<tr>
<td>80</td>
</tr>
<tr>
<td>100</td>
</tr>
<tr>
<td>120</td>
</tr>
<tr>
<td>140</td>
</tr>
<tr>
<td>160</td>
</tr>
</tbody>
</table>

Accuracy of Mixing Ratio g/kg (Ambient Pressure 1013 mbar)

<table>
<thead>
<tr>
<th>Relative humidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temp.</td>
</tr>
<tr>
<td>-40</td>
</tr>
<tr>
<td>-20</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>20</td>
</tr>
<tr>
<td>40</td>
</tr>
<tr>
<td>60</td>
</tr>
<tr>
<td>80</td>
</tr>
<tr>
<td>100</td>
</tr>
<tr>
<td>120</td>
</tr>
</tbody>
</table>
### Accuracy of Wet Bulb Temperature °C

<table>
<thead>
<tr>
<th>Relative humidity</th>
<th>Temp.</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-20</td>
<td>0.21</td>
<td>0.21</td>
<td>0.22</td>
<td>0.22</td>
<td>0.22</td>
<td>0.22</td>
<td>0.22</td>
<td>0.23</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0.27</td>
<td>0.28</td>
<td>0.28</td>
<td>0.29</td>
<td>0.29</td>
<td>0.29</td>
<td>0.30</td>
<td>0.30</td>
<td>0.31</td>
<td>0.31</td>
<td>0.31</td>
</tr>
<tr>
<td>20</td>
<td>0.45</td>
<td>0.45</td>
<td>0.45</td>
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### Accuracy of Absolute Humidity g/m³

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Dewpoint Temperature (HMT337 Warmed Probe Option)

Find the intersection of the dewpoint temperature curve and the dewpoint difference reading (process temperature-dewpoint temperature) on the x-axis and read the accuracy in dewpoint measurement on the y-axis.

![Figure 81 Accuracy in Dewpoint Measurement](image)

Operating Environment

Operating temperature range
- for humidity measurement: -70 ... +180 °C (-94 ... +356 °F)
- see probe specifications
- for transmitter body electronics: -40 ... +60 °C (40 ... +140 °F)
- with display: 0 ... +60 °C (+32 ... +140 °F)

Storage temperature range
- without display: -55 ... +80 °C (-67 ... +176 °F)
- with display: -40 ... +80 °C (-40 ... +176 °F)

Electromagnetic compatibility
EN61326-1: Electrical equipment for measurement, control, and laboratory use – EMC requirements – for use in industrial locations
# Inputs and Outputs

| Operating voltage                               | 10 ... 35 VDC, 24 VAC |
| Start-up time after power-up                    | 3 s                  |
| Power consumption at 20 °C (Uin 24VDC)          | max 25 mA            |
| RS-232                                         | max 25 mA            |
| Uout $2 \times 0 \ldots 1V / 0 \ldots 5V / 0 \ldots 10V$ | max 60 mA            |
| Iout $2 \times 0 \ldots 20 mA$                  | + 20 mA              |
| display and backlight                           | + 110 mA max         |
| during sensor purge                             |                      |
| Analog outputs (2 standard, 3rd optional)       | 0 ... 20 mA, 4 ... 20 mA |
| voltage output                                  | 0 ... 1 V, 0 ... 5 V, 0 ... 10 V |
| Accuracy of analog outputs at 20 °C             | ± 0.05 % full scale   |
| Temperature dependence of the analog outputs    | ± 0.005 %/°C full scale |
| External loads                                  |                      |
| current outputs                                 | RL < 500 ohm         |
| 0 ... 1V output                                 | RL > 2 kohm          |
| 0 ... 5V and 0 ... 10V outputs                  | RL > 10 kohm         |
| Wire size                                       | 0.5 ... 2.5 mm² (AWG 20 ... 14) |
| stranded wires recommended                     |                      |
| Digital outputs                                 | RS-232               |
| RS-422/485 (optional)                           | RS-422/485 (optional) |
| LAN (optional)                                  | LAN (optional)       |
| WLAN (optional)                                 | WLAN (optional)      |
| Protocols                                       | ASCII commands       |
| ASCII commands                                  | Modbus RTU           |
| Modbus TCP                                      |                      |
| Relay outputs (optional)                        | 0.5 A, 250 VAC, SPDT |
| Display (optional)                              | LCD with backlight, graphic trend display |
| Menu languages                                  | Chinese, English, Finnish, French, German, Japanese, Russian, Spanish, Swedish |
Mechanics

Cable bushing

- M20x1.5 for cable diameter 8 ... 11 mm/0.31...0.43"

Conduit fitting

- 1/2"NPT

User cable connector (optional)

- M12 series 8-pin (male)
  - with plug (female) with 5 m / 16.4 ft black cable
  - with plug (female) with screw terminals

Option 1 with plug (female) with 5 m / 16.4 ft black cable

Option 2 with plug (female) with screw terminals

Probe cable diameter

- HMT333 80ºC 6.0 mm
- Other probes 5.5 mm

Probe tube material

- HMT331 Chromed ABS plastic
- Other probes AISI 316L

Housing material

- G-AlSi 10 Mg (DIN 1725)

Housing classification

- Without display IP 66 (NEMA 4X)
- With display and keypad IP 65 (NEMA 4X)

Transmitter weight (with probe, cable, and modules)

- 1.0 ... 3.0 kg (2.2 ... 6.6 lb)

Table 37 Standard Probe Cable Lengths and Approximate Transmitter Weight (in kg/lb)

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<th>Probe Type</th>
<th>Probe Cable Length</th>
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</table>
Technical Specifications of Optional Modules

**Power Supply Module**

Operating voltage
- 100 ... 240 VAC 50/60 Hz

Connections
- screw terminals for 0.5 ... 2.5 mm² wire (AWG 20 ... 14)

Bushing
- for 8 ... 11 mm diameter cable

Operating temperature
- -40 ... +60 °C (-40 ... +140 °F)

Storage temperature
- -40 ... +70°C (-40 ... +158 °F)

UL file number
- E249387

**Analog Output Module**

Outputs
- 0 ... 20 mA, 4 ... 20 mA,
- 0 ... 1 V, 0 ... 5 V, 0 ... 10 V
- -40 ... +60 °C (-40 ... +140 °F)

Power consumption
- U_out 0 ... 1 V max 30 mA
- U_out 0 ... 5V/0 ... 10V max 30 mA
- I_out 0 ... 20 mA max 60 mA

External loads
- current outputs
- R_L < 500 ohms
- 540 ohms
- R_L > 2000 ohms
- R_L > 10 000 ohms

Max load + cable loop resistance
- 0 ... 1 V
- 0 ... 5 V and 0 ... 10 V

Storage temperature range
- -55 ... +80 °C (-67 ... +176 °F)

3-pole screw terminal
- max wire size
- 1.5 mm² (AWG16)

**Relay Module**

Operating temperature range
- -40 ... +60 °C (-40 ... +140 °F)

Operating pressure range
- 500 ... 1300 mmHg

Power consumption at 24 V
- max 30 mA

Contacts SPDT (change over), for example,
- Contact arrangement Form C
- I_max
- 0.5 A 250 VAC
- 0.5 A 30 VDC

Safety standard for the relay component
- IEC60950 UL1950

Storage temperature range
- -55 ... +80 °C (-67 ... +176 °F)

3-pole screw terminal / relay
- max wire size
- 2.5 mm² (AWG14)
### RS-485 Module

- **Operating temperature range**: -40 ... +60 °C (-40 ... +140 °F)
- **Operating modes**: 2-wire (1-pair) half duplex, 4-wire (2-pair) full duplex
- **Operating speed max**: 115.2 kbaud
- **Bus isolation**: 300VDC
- **Power consumption at 24V max**: 50 mA
- **External loads**: standard loads
- **Storage temperature range**: -55 ... +80 °C (-67 ... +176 °F)
- **Max wire size**: 1.5 mm² (AWG16)

### LAN Interface Module

- **Operating temperature range**: -40 ... +60 °C (-40 ... +140 °F)
- **Storage temperature range**: -40 ... +85 °C (-40 ... +185 °F)
- **Operating humidity range**: 5 ... 95 %RH
- **Power consumption at 24V**: max 60 mA
- **Ethernet type**: 10BASE-T 100BASE-TX
- **Connector**: 8P8C (RJ45)
- **IPv4 address assignment**: DHCP (automatic), static
- **Protocols**: Telnet, Modbus TCP
- **Max number of Telnet/Modbus clients**: 1

### WLAN Interface Module

- **Operating temperature range**: -20 ... +60 °C (-4 ... +140 °F)
- **Storage temperature range**: -40 ... +85 °C (-40 ... +185 °F)
- **Operating humidity range**: 5 ... 95 %RH
- **Power consumption at 24V**: max 80 mA
- **Supported standards**: 802.11b
- **Connector**: RP-SMA
- **IPv4 address assignment**: DHCP (automatic), static
- **Protocols**: Telnet, Modbus TCP
- **Max number of Telnet/Modbus clients**: 1
- **Security**: WEP 64/128, WPA2/802.11i

### Data Logger Module

- **Operating temperature range**: -40 ... +60 °C (-40 ... +140 °F)
- **Storage temperature range**: -55 ... +80 °C (-67 ... +176 °F)
- **Power consumption at 24V**: max 10 mA
- **Logged parameters**: up to four with trend/min/max values for each
- **Logging interval**: 10 s (fixed)
- **Maximum logging period**: 4 years 5 months
- **Logged points**: 13.7 million points / parameter
- **Accuracy of the clock**: better than ±2 min/year
- **Battery lifetime**: 7 years at -40 ... +30 °C (-40 ... +86 °F), 5 years at +30 ... +60 °C (+86 ... +140 °F)
Spare Parts and Accessories

Information on spare parts, accessories, and calibration products is available online at [www.vaisala.com](http://www.vaisala.com) and [store.vaisala.com](http://store.vaisala.com).

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<td>Isolated RS485 Module</td>
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</tr>
<tr>
<td>Cable Gland M16x1.5 for Wall Mounting Plate Pass-Through</td>
<td>216681SP</td>
</tr>
<tr>
<td>Conduit Fitting M20x1.5 for NPT1/2 Conduit</td>
<td>214780SP</td>
</tr>
<tr>
<td>Dummy Plug M20x1.5</td>
<td>214672SP</td>
</tr>
<tr>
<td><strong>WINDOWS SOFTWARE</strong></td>
<td></td>
</tr>
<tr>
<td>Software Interface Kit</td>
<td>215005</td>
</tr>
<tr>
<td><strong>OTHER</strong></td>
<td></td>
</tr>
<tr>
<td>HMK15 Calibration Adapter for 12 mm Probes with &gt;7 mm Sensor Pins</td>
<td>211302SP</td>
</tr>
<tr>
<td>HMK15 Calibration Adapter for 12 mm Probes with &lt;3 mm Sensor Pins</td>
<td>218377SP</td>
</tr>
<tr>
<td>Enclosure spare kit: hexagonal cover screws (4x) and hinge with attachment screws</td>
<td>238509</td>
</tr>
</tbody>
</table>
Dimensions (mm/inch)

Figure 82  Transmitter Body Dimensions
Figure 83  WLAN Antenna Dimensions
Figure 84  HMT331 Fixed Probe Dimensions

Figure 85  HMT331 Short Cable Probe Dimensions
The flange is available as an option for the HMT335 probe.
HMT337

Figure 89  HMT337 Probe Dimensions

HMT338

Figure 90  HMT338 Probe Dimensions

Temperature Probe

Figure 91  Optional Temperature Probe Dimensions
APPENDIX A

PROBE INSTALLATION KITS AND INSTALLATION EXAMPLES

Duct Installation Kits (for HMT333/337/335)

Duct installation kit includes a flange, a sealing ring, a supporting bar, a probe attaching part, and screws for attaching the flange to the duct wall. Vaisala order codes: 210697 (for HMT333 and HMT337), 210696 (for HMT335, no supporting bar), and 215003 for temperature probe.

![Figure 92 Duct Mounting Installation Kit](image)

The following numbers refer to Figure 92:

1 = Duct wall  
2 = Flange  
3 = Sealing ring  
4 = Supporting bar (not included in the kit for HMT335)  
5 = Probe attaching part (to be fixed with the supporting bar)  
6 = Relative humidity probe

**NOTE**

When the temperature difference between the duct and the air outside the duct is remarkable, the supporting bar must be installed as deep in the duct as possible. This prevents errors caused by the heat conduction in the bar and cable.
Duct Installation Kit for Temperature Probe (for HMT337)

Vaisala duct installation kit for the T-probe includes flange, supporting bar, probe attaching part, sealing ring and the fixing screws (4 pcs). Vaisala order code: 215003.

Figure 93   Duct Mounting Installation Kit for T-Probe

The following numbers refer to Figure 93:

1  =  Duct wall  
2  =  Flange  
3  =  Sealing ring  
4  =  Supporting bar  
5  =  Probe support (to be fixed to the supporting bar)  
6  =  Retainer bushing (to be fixed to the probe support)  
7  =  Temperature probe (to be fixed to the retainer bushing)
Pressure Tight Swagelok Installation Kits (for HMT337)

**RH Probe Installation**

Swagelok installation kit for the relative humidity probe includes Swagelok connector with ISO3/8" or NPT1/2" thread. Vaisala order codes: SWG12ISO38 or SWG12NPT12.

![RH Probe Installation Diagram](image)

The following numbers refer to Figure 94:

1 = Relative humidity probe  
2 = Duct connector  
3 = ISO3/8" or NPT1/2" thread  
4 = Swagelok connector  
5 = Ferrules

**Temperature Probe Installation**

Swagelok installation kit for T-probe includes Swagelok connector with either ISO1/8" or NPT1/8" thread. Vaisala order codes: SWG6ISO18 or SWG6NPT18.

![Temperature Probe Installation Diagram](image)

The following numbers refer to Figure 95:

1 = T-probe  
2 = Duct connector  
3 = Swagelok connector  
4 = Ferrules
Examples of Vapor Tight Installations with Cable Gland

RH-Probe Installations (for HMT333/337)

Cable gland AGRO is available from Vaisala (order code: HMP247CG.)

![Diagram of Cable Installation with Cable Gland]

Figure 96 Cable Installation with Cable Gland

The following numbers refer to Figure 96:
1 = Nut (to be tightened to the body)  
2 = Seal  
3 = Body and O-ring

![Diagram of Probe Installation with Cable Gland]

Figure 97 Probe Installation with Cable Gland

Probe installation with cable gland is not available from Vaisala.  
The following numbers refer to Figure 97:
1 = AGRO 1160.20.145 (T= -40 ... +100 °C) Not available from Vaisala.
2 = In pressurized places, use a locking ring (for example: 11× 1 DIN471).
T- Probe Installations (HMT337)

Figure 98    Vapor Tight Installation

Vapor Tight Installation is not available from Vaisala.

The following numbers refer to Figure 98:

1 = Cable gland. For example AGRO 1100.12.91.065  
   (T= -25 ... +200 °C)
2 = In pressurized processes, use a locking ring 
   (example: 6x 0.7 DIN471)

Figure 99    Wall Mounting Installation

Wall Mounting Installation is not available from Vaisala.

The following numbers refer to Figure 99:

1 = Cable gland. For example AGRO 1100.12.91.065
2 = Compacted PTFE sleeve
3 = Silicon glue between the PTFE sleeve and the cable
4 = Temperature probe
5 = Recommended support to keep the probe in horizontal position
Example of Climate Chamber Installation

Figure 100 Climate Chamber Installation (not Available from Vaisala)

The following numbers refer to Figure 100:
1 = PTFE sleeve
2 = Cable gland, for example: AGRO 1100.12.91.065
3 = Stainless steel cable tie or similar fastener
4 = To be sealed (silicone)
5 = Temperature probe
6 = Relative humidity probe
7 = HMP247CG, Cable gland AGRO (available from Vaisala)

NOTE Let the cables hang loosely to prevent condensed water running to the probe.
Example of Installation Through Roof

Outdoor environment

Process:
For example
+85 °C, 85 %RH

Figure 101  Example of Installation through Roof

The following numbers refer to Figure 101:

1 = Insulated probe cables
2 = Sealings
3 = Roof
4 = Cable gland for temperature probe (for example: AGRO 1100.12.91.065)
5 = Temperature probe
6 = Relative humidity probe
7 = Cable gland for relative humidity probe (for example: AGRO 1160.20.145)
8 = Plastic adapter to protect probes from condensation water coming from the pipe. Diameter slightly smaller than tube diameter.
9 = Plastic tube for probe (2 pcs)
10 = Stainless steel tube coming through the roof
11 = Two thread bars holding the plastic adapter
12 = Insulated pipe ending
Ball Valve Installation Kit for HMT338

The ball valve installation kit (Vaisala order code: BALLVALVE-1) is preferred when connecting the probe to a pressurized process or pipeline. Use the ball valve set or a 1/2" ball valve assembly with a ball hole of ø14 mm or more. If you install the probe (ø12 mm) in a process pipe, please note that the nominal size of the pipe must be at least 1 inch (2.54 cm). Use the manual press handle to press the probe into the pressurized (< 10 bar) process or pipeline.

![Figure 102 Installing the HMT338 Probe Through a Ball Valve Assembly](image)

The following numbers refer to Figure 102:

1 = Manual press tool
2 = Handle of the ball valve
3 = Probe
4 = Process chamber or pipeline
5 = Groove on the probe indicates the upper adjustment limit
6 = Filter
7 = Ball of the ball valve
8 = Fitting screw
The probe can be installed in the process through the ball valve assembly provided that the process pressure is less than 10 bars. This way, the process does not have to be shut down when installing or removing the probe. However, if the process is shut down before removing the probe, the process pressure can be max. 20 bars.

When measuring temperature dependent quantities make sure that the temperature at the measurement point is equal to that of the process, otherwise the moisture reading may be incorrect.

Follow the steps below to install the HMT338 probe through a ball valve assembly. After the installation, the probe should be sitting in the process chamber or pipeline as shown in Figure 102 on page 192.

1. Shut down the process if the process pressure is more than 10 bars. If the pressure is lower there is no need to shut down the process.
2. Close the ball valve.
3. Seal the threads on the fitting body; refer to Figure 29 on page 47.
4. Attach the fitting body to the ball valve and tighten it.
5. Slide the clasp nut of the probe toward the filter, as far as it will go.
6. Insert the probe to the fitting body, and manually tighten the clasp nut to the fitting body.
7. Open the ball valve.
8. Push the probe through the ball valve assembly into the process. If the pressure is high, use the pressing handle that is provided with the probe. If you push the probe hard without using the handle, you may damage the cable.

Note that the probe must be pushed so deep that the filter is completely inside the process flow.

9. Mark the fitting screw and the clasp nut.
10. Tighten the clasp nut with a fork wrench a further 50 ... 60° (ca. 1/6 turn). If you have a suitable torque wrench, tighten the nut to max 45 ± 5 Nm (33 ± 4 ft-lbs). Refer to Figure 30 on page 48.

Take care not to tighten the clasp nut more than 60° to avoid difficulties when opening it.

If you wish to remove the probe from the process, note that you have to pull the probe out far enough. You cannot close the valve if the groove on the probe body is not visible.
The Vaisala Meteorological Installation Kit HMT330MIK (Vaisala order code: HMT330MIK) enables the HMT337 to be installed outdoors to obtain reliable measurements for meteorological purposes. For more information, see HMT330MIK brochure and order form.

**Figure 103  Meteorological Installation Kit for Outdoor Installation**
APPENDIX B

CALCULATION FORMULAS

This Appendix contains the formulas used for the calculated output quantities.

The HMT330 series transmitters measure relative humidity and temperature. From these values dewpoint, mixing ratio, absolute humidity and enthalpy in normal pressure are calculated using the following equations:

Dewpoint:

\[
T_d = \frac{T_n}{m} \left( \log\left( \frac{P_w}{A} \right) \right)^{-1}
\]

(1)

\(P_w\) is the water vapor pressure. The parameters \(A\), \(m\), and \(T_n\) depend on temperature according to the following table:

<table>
<thead>
<tr>
<th>t</th>
<th>A</th>
<th>m</th>
<th>T_n</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0 °C(^1)</td>
<td>6.1134</td>
<td>9.7911</td>
<td>273.47</td>
</tr>
<tr>
<td>0 ... 50 °C</td>
<td>6.1078</td>
<td>7.5000</td>
<td>237.3</td>
</tr>
<tr>
<td>50 ... 100 °C</td>
<td>5.9987</td>
<td>7.3313</td>
<td>229.1</td>
</tr>
<tr>
<td>100 ... 150 °C</td>
<td>5.8493</td>
<td>7.2756</td>
<td>225.0</td>
</tr>
<tr>
<td>150 ... 180 °C</td>
<td>6.2301</td>
<td>7.3033</td>
<td>230.0</td>
</tr>
</tbody>
</table>

\(^1\) Used for frostpoint calculation if the dewpoint is negative
Mixing ratio:

\[ x = 621.99 \times \frac{P_w}{p - P_w} \]  \hspace{1cm} (2)

Absolute humidity:

\[ a = 216.68 \times \frac{P_w}{T} \]  \hspace{1cm} (3)

Enthalpy:

\[ h = (T - 273.15) \cdot (1.01 + 0.00189 \cdot x) + 2.5 \cdot x \]  \hspace{1cm} (4)

The water vapor saturation pressure \( P_{ws} \) is calculated by using two equations (5 and 6):

\[ \Theta = T - \sum_{i=0}^{3} C_i T^i \]  \hspace{1cm} (5)

where:

\[ T = \text{temperature in K} \]
\[ C_i = \text{coefficients} \]
\[ C_0 = 0.4931358 \]
\[ C_1 = -0.46094296 \times 10^{-2} \]
\[ C_2 = 0.13746454 \times 10^{-4} \]
\[ C_3 = -0.12743214 \times 10^{-7} \]

\[ \ln P_{ws} = \sum_{i=-1}^{3} b_i \Theta^i + b_4 \ln \Theta \]  \hspace{1cm} (6)

where:

\[ b_i = \text{coefficients} \]
\[ b_{-1} = -0.58002206 \times 10^4 \]
\[ b_0 = 0.13914993 \times 10^1 \]
\[ b_1 = -0.48640239 \times 10^{-1} \]
\[ b_2 = 0.41764768 \times 10^{-4} \]
\[ b_3 = -0.14452093 \times 10^{-7} \]
\[ b_4 = 6.5459673 \]
The water vapor pressure is calculated using:

\[ P_w = RH \cdot \frac{P_{ws}}{100} \]  \hspace{1cm} (7)

Parts per million by volume is calculated using:

\[ ppm_v = 10^6 \cdot \frac{P_w}{(p - P_w)} \]  \hspace{1cm} (8)

Symbols:
- \( T_d \) = dewpoint temperature (°C)
- \( P_w \) = water vapor pressure (hPa)
- \( P_{ws} \) = water vapor saturation pressure (Pa)
- \( RH \) = relative humidity (%)
- \( x \) = mixing ratio (g/kg)
- \( p \) = atmospheric pressure (hPa)
- \( A \) = absolute humidity (g/m³)
- \( T \) = temperature (K)
- \( h \) = enthalpy (kJ/kg)
This page intentionally left blank.
This appendix describes the Modbus functions and data of the transmitter.

**Function Codes**

HMT330 supports all Modbus conformance class 0 and class 1 function codes defined in Open Modbus/TCP Specification, Release 1.0.

<table>
<thead>
<tr>
<th>Function Code</th>
<th>Name</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 (0x01)</td>
<td>Read Coils</td>
<td>Class 1</td>
</tr>
<tr>
<td>02 (0x02)</td>
<td>Read Discrete Inputs</td>
<td>Class 1</td>
</tr>
<tr>
<td>03 (0x03)</td>
<td>Read Holding Registers</td>
<td>Class 0</td>
</tr>
<tr>
<td>04 (0x04)</td>
<td>Read Input Registers</td>
<td>Class 1</td>
</tr>
<tr>
<td>05 (0x05)</td>
<td>Write Single Coil</td>
<td>Class 1</td>
</tr>
<tr>
<td>06 (0x06)</td>
<td>Write Single Register</td>
<td>Class 1</td>
</tr>
<tr>
<td>07 (0x07)</td>
<td>Read Exception Status</td>
<td>Class 1</td>
</tr>
<tr>
<td>08 (0x08)</td>
<td>Diagnostics</td>
<td></td>
</tr>
<tr>
<td>15 (0x0F)</td>
<td>Write Multiple Coils</td>
<td>Class 2</td>
</tr>
<tr>
<td>16 (0x10)</td>
<td>Write Multiple Registers</td>
<td>Class 0</td>
</tr>
<tr>
<td>22 (0x16)</td>
<td>Mask Write Register</td>
<td>Class 2</td>
</tr>
<tr>
<td>23 (0x17)</td>
<td>Read/Write Multiple Registers</td>
<td>Class 2</td>
</tr>
<tr>
<td>43 / 14 (0x2B / 0x0E)</td>
<td>Read Device Identification</td>
<td></td>
</tr>
</tbody>
</table>

Class 0 function codes are enough to access all measurement data and configuration settings of the HMT330 transmitter. In addition, all class 1 and some class 2 commands are also supported giving better compatibility and allowing more efficient communication when needed.

Modbus diagnostic and device identification data can be read out only with the function codes dedicated for those purposes (08 and 43 / 14).
Register Map

All data available via the Modbus interface is grouped in six contiguous blocks of registers as described in Table 40 below.

Table 40  HMT330 Modbus Register Blocks

<table>
<thead>
<tr>
<th>Address</th>
<th>Data Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0001…0068</td>
<td>32-bit IEEE float</td>
<td>Measurement data (read-only)</td>
</tr>
<tr>
<td>0257…0290</td>
<td>16-bit signed integer</td>
<td></td>
</tr>
<tr>
<td>0513…0517</td>
<td>Bit field</td>
<td>Status registers (read-only)</td>
</tr>
<tr>
<td>0769…0790</td>
<td>32-bit IEEE float</td>
<td>Configuration settings</td>
</tr>
<tr>
<td>1025…1035</td>
<td>16-bit signed integer</td>
<td></td>
</tr>
<tr>
<td>1281…1288</td>
<td>Bit field</td>
<td>Configuration flags</td>
</tr>
</tbody>
</table>

The addresses are 1-based decimal Modbus data model addresses without the first digit (e.g. 0xxxx, 1xxxx, 3xxxx, or 4xxxx). Subtract 1 to get address field values used in Modbus Protocol Data Unit (PDU).

The register map is the same for all Modbus function codes. For example, function codes 03 and 04 return exactly same result, as do 01 and 02.

Function codes 01 and 02 return 0 if the corresponding register has value 0x0000 and 1 if the register is non-zero. Writing with function codes 05 or 15 effectively writes value 0x0000 or 0x0001 in the register(s).

Data Encoding

All numeric values are available both in 32-bit IEEE floating point and 16-bit signed integer formats.

32-Bit Floating Point Format

Floating point values are represented in standard IEEE 32-bit floating point format. Least-significant 16 bits of floating point numbers are placed at the smaller Modbus address as specified in Open Modbus TCP Specification, Release 1.0. This is also known as “little-endian” or “Modicon” word order.

NOTE

Despite the specification, some Modbus masters may expect “big-endian” word order (most-significant word first). In such case, you must select “word-swapped” floating point format in your Modbus master for HMT330 Modbus registers.

A “quiet NaN” value is returned for unavailable values. Writing any NaN or infinite value is silently ignored. A quiet NaN is, for example, 0x7FC00000; however, the master should understand any NaN value.
A complete 32-bit floating point value should be read and written in a single Modbus transaction (e.g. function codes 05, 06, and 22 do not have an effect on floating point values).

### 16-Bit Integer Format

16-bit integer values are scaled to include the necessary decimals (see corresponding register table for the scaling factor). Negative values (when applicable) are represented in 2’s complement (65535 = -1, 65534 = -2, etc.).

If the scaled value does not fit in the range 0…65535 (16-bit range), the value is “wrapped” to the range by adding or subtracting 65536 as many times as needed.

For example, mixing ratio (x) value 658.92 g/kg is returned in 16-bit integer format as 356 (0x0164). You will need to add suitable offset to the 16-bit data in the Modbus master to get valid value out:

\[
356\text{ (16-bit register value)} + 65536\text{ (offset)} = 65892\text{ --> 658.92 g/kg (scaled by } \times 0.01)\text{.}
\]

However, most of the measurement data values do not need any offset.

A zero 16-bit value is returned for unavailable values. There is no way to distinguish missing values from actual zero values if the zero value is included in the valid measurement range of the parameter.

If your Modbus master supports 32-bit floating point values, always use them instead of 16-bit integer registers.

The use of 16-bit integer values is not recommended in critical applications because you cannot distinguish true zero values from zero values generated by measurement failures.

In addition to this, 2’s complement makes negative values look like large positive values, which must be taken into account when utilizing the 16-bit register values.

When writing 16-bit values in configuration registers, they are always processed as signed integers in the range of -32768…+32767. You shall
use the floating point registers to write values outside this 16-bit signed integer range. Maximum writable value is 32767 also for configuration registers that do not accept negative values.

**Measurement Data (Read-Only)**

**Table 41 Measurement Data Registers**

<table>
<thead>
<tr>
<th>Name</th>
<th>Float</th>
<th>Integer</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>RH</td>
<td>0001…0002</td>
<td>0257 (×0.01)</td>
<td>%</td>
</tr>
<tr>
<td>T</td>
<td>0003…0004</td>
<td>0258 (×0.01)</td>
<td>°C</td>
</tr>
<tr>
<td>T_d</td>
<td>0007…0008</td>
<td>0260 (×0.01)</td>
<td>°C</td>
</tr>
<tr>
<td>T_WS</td>
<td>0009…0010</td>
<td>0261 (×0.01)</td>
<td>°C</td>
</tr>
<tr>
<td>a</td>
<td>0015…0016</td>
<td>0264 (×0.01)</td>
<td>g/m³</td>
</tr>
<tr>
<td>x</td>
<td>0017…0018</td>
<td>0265 (×0.01)</td>
<td>g/kg</td>
</tr>
<tr>
<td>T_p</td>
<td>0019…0020</td>
<td>0266 (×0.01)</td>
<td>°C</td>
</tr>
<tr>
<td>H₂O</td>
<td>0021…0022</td>
<td>0267 (×1)</td>
<td>ppmV</td>
</tr>
<tr>
<td>ρ_a</td>
<td>0023…0024</td>
<td>0268 (×0.1)</td>
<td>hPa</td>
</tr>
<tr>
<td>ρ_ws</td>
<td>0025…0026</td>
<td>0269 (×0.1)</td>
<td>hPa</td>
</tr>
<tr>
<td>H</td>
<td>0027…0028</td>
<td>0270 (×0.01)</td>
<td>kJ/kg</td>
</tr>
<tr>
<td>ΔT</td>
<td>0031…0032</td>
<td>0272 (×0.01)</td>
<td>°C</td>
</tr>
<tr>
<td>H₂O</td>
<td>0065…0066</td>
<td>0289 (×1)</td>
<td>ppmW</td>
</tr>
</tbody>
</table>

Available measurements depend on the instrument configuration. Values may be unavailable also in case of device failure. Read status registers or exception status outputs to check for failures.

**NOTE** Only real-time data can be read from the instrument. Data that is recorded in the transmitter’s memory (internal memory or data logger module) cannot be read through Modbus.

**Status Registers (Read-Only)**

**Table 42 Status Registers**

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fault status</td>
<td>0513</td>
<td>1 = No errors</td>
</tr>
<tr>
<td>Online status</td>
<td>0514</td>
<td>1 = Online data available</td>
</tr>
<tr>
<td>Error code (bits 15…0)</td>
<td>0516</td>
<td>Bit field that represents the error codes listed in Table 33 on page 152. Active errors are set to 1. For example, if bit 14 is set to 1, error code E14 is active.</td>
</tr>
<tr>
<td>Error code (bits 31…16)</td>
<td>0517</td>
<td></td>
</tr>
</tbody>
</table>

Error information can retrieved also with function code 08, sub-function 02.
NOTE

Basic status information of the HMT330 transmitter is also available with the Read Exception Status function code 07. For details, see section Exception Status Outputs on page 204.

Configuration Registers

Configuration parameter registers are used to configure the measurement. Writing out-of-range values is silently ignored.

**Table 43 Configuration Parameter Registers**

<table>
<thead>
<tr>
<th>Name</th>
<th>Float</th>
<th>Integer</th>
<th>Valid Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure setting default value</td>
<td>0769…0770</td>
<td>1025 (×1)</td>
<td>0…9999 hPa</td>
</tr>
<tr>
<td>Pressure setting temporary value</td>
<td>0771…0772</td>
<td>1026 (×1)</td>
<td>0…9999 hPa</td>
</tr>
<tr>
<td>Chemical purge interval</td>
<td>0773…0774</td>
<td>1027 (×1)</td>
<td>10…2880 min</td>
</tr>
<tr>
<td>Molecular weight for ppm&lt;sub&gt;calc&lt;/sub&gt; calculation</td>
<td>0775…0776</td>
<td>1028 (×0.001)</td>
<td>0…999.999 g/mol</td>
</tr>
</tbody>
</table>

If you modify the pressure setting repeatedly, modify the temporary value at register 0771…0772 (1026) instead of the permanent setting at register 0769…0770 (1025). Set the temporary value to zero to return to the default pressure setting.

Non-metric units are not available on Modbus. If they are needed, calculate the conversion outside the transmitter.

Configuration flags are used to select some basic options of the instrument and to manually start the sensor operations.

**Table 44 Configuration Flag Registers**

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard filtering on/off</td>
<td>1281</td>
<td>1 = Filtering on</td>
</tr>
<tr>
<td>Extended filtering on/off</td>
<td>1282</td>
<td>1 = Extended filtering on</td>
</tr>
<tr>
<td>Automatic chemical purge on/off</td>
<td>1283</td>
<td>1 = Automatic purge on. See configuration register 0773…0774 (1027).</td>
</tr>
<tr>
<td>Start-up chemical purge on/off</td>
<td>1284</td>
<td>1 = Start-up purge on</td>
</tr>
<tr>
<td>Chemical purge in progress</td>
<td>1285</td>
<td>1 = Purge in progress (write 1 for manual start)</td>
</tr>
<tr>
<td>Sensor heating on/off</td>
<td>1287</td>
<td>1 = Sensor heating on (optional feature)</td>
</tr>
</tbody>
</table>

Flags 1281 and 1282 are mutually exclusive.

Some of the configuration registers might not have an effect depending on the instrument model and configuration.
Other configuration settings are not usually needed and are not available using the Modbus interface. The service cable must be used to change other configuration settings if needed.

**Exception Status Outputs**

Exception status outputs (read with function code 07) tell the summary of the HMT330 transmitter status as described in Table 45 below.

<table>
<thead>
<tr>
<th>Output</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 (0x01)</td>
<td>Fault status</td>
<td>1 = No errors</td>
</tr>
<tr>
<td>1 (0x02)</td>
<td>Online status</td>
<td>1 = Online data available</td>
</tr>
</tbody>
</table>

Status information is available also with register access; see section Status Registers (Read-Only) on page 202.

**Diagnostic Sub-Functions**

HMT330 supports some of the Modbus diagnostic functions described in the Modbus Application Protocol Specification V1.1b. These diagnostic functions are accessed with function code 08. See Table 46 below for details.

<table>
<thead>
<tr>
<th>Code</th>
<th>Sub-Function Name</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>00 (0x00)</td>
<td>Return Query Data</td>
<td></td>
</tr>
<tr>
<td>01 (0x01)</td>
<td>Restart Communications Option</td>
<td>Cancels the “Listen Only” mode. Data field must be set to “00 00” for Restart Communications Option. Sub-Function 01 with data field “FF 00” is rejected.</td>
</tr>
<tr>
<td>02 (0x02)</td>
<td>Return Diagnostic Register</td>
<td>Non-zero if there are active transmitter errors. For same error information, see status registers 0516 and 0517. The value of the Diagnostic Register is a logical OR of these two status registers.</td>
</tr>
<tr>
<td>04 (0x04)</td>
<td>Force Listen Only Mode</td>
<td>Puts device “off-line”</td>
</tr>
<tr>
<td>10 (0x0A)</td>
<td>Clear Counters and Diagnostic Register</td>
<td>Diagnostic Register cannot be cleared</td>
</tr>
<tr>
<td>11 (0x0B)</td>
<td>Return Bus Message Count</td>
<td>Total number of messages seen on the bus/interface</td>
</tr>
<tr>
<td>12 (0x0C)</td>
<td>Return Bus Communication Error Count</td>
<td>Number of messages with bad Modbus RTU CRC or Modbus TCP frame</td>
</tr>
</tbody>
</table>
### Device Identification Objects

HMT330 Modbus conforms to the extended identification level defined in the Modbus Application Protocol Specification V1.1b. Both stream access and individual access to the objects is supported.

<table>
<thead>
<tr>
<th>Object Id</th>
<th>Object Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x00</td>
<td>VendorName</td>
<td>“Vaisala”</td>
</tr>
<tr>
<td>0x01</td>
<td>ProductCode</td>
<td>Product code (e.g. “HMT330”)</td>
</tr>
<tr>
<td>0x02</td>
<td>MajorMinorVersion</td>
<td>Software version (e.g. “5.1.0”)</td>
</tr>
<tr>
<td>0x03</td>
<td>VendorUrl</td>
<td>“<a href="http://www.vaisala.com/%E2%80%9D">http://www.vaisala.com/”</a></td>
</tr>
<tr>
<td>0x04</td>
<td>ProductName</td>
<td>Product name of the instrument</td>
</tr>
<tr>
<td>0x80</td>
<td>SerialNumber</td>
<td>Serial number (e.g. “D0710040”)</td>
</tr>
<tr>
<td>0x81</td>
<td>CalibrationDate</td>
<td>Date of the last calibration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(e.g. “2011-02-07”, empty if not available)</td>
</tr>
<tr>
<td>0x82</td>
<td>CalibrationText</td>
<td>Information text of the last calibration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(empty if not available)</td>
</tr>
</tbody>
</table>
Exception Responses

Exception responses from the transmitter are according to the Modbus Application Protocol Specification V1.1b.

Table 48 HMT330 Modbus Exception Responses

<table>
<thead>
<tr>
<th>Code</th>
<th>Name</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>ILLEGAL FUNCTION</td>
<td>Unsupported function code</td>
</tr>
<tr>
<td>02</td>
<td>ILLEGAL DATA ADDRESS</td>
<td>Address out of valid ranges</td>
</tr>
<tr>
<td>03</td>
<td>ILLEGAL DATA VALUE</td>
<td>Otherwise invalid request</td>
</tr>
</tbody>
</table>

Accessing unavailable (unsupported or temporarily missing) registers inside ranges specified in Table 41 does not generate an exception. “Unavailable” value (a quiet NaN for floating point data or zero for integer data) is returned instead. An exception is generated only for any access outside the register blocks defined in section Register Map on page 200.